AMERICAN

DYESTUFF REPORTER

Volume 47 July 28, 1958 Number 15

RESISTANCE TO CHLORINE DAMAGE IN HOME-TYPE LAUNDERING OF CEU-TREATED WASH-AND-WEAR COTTON FABRICS

ROBERT M REINHARDT, LAURENCE W MAZZENO JR, TERRENCE W FENNER, AND J DAVID REID

Southern Regional Research Laboratory[1]
New Orleans, La

Cotton fabric treated with CEU (dimethylol cyclic ethyleneurea) resin has been subjected to home-type laundering particularly in the presence of chlorine bleach. The resin finish was applied with three types of catalysts and under various conditions of cure. Properties of the original resin-treated fabric—breaking strength, wrinkle-recovery angle, color, and nitrogen content—are essentially unchanged after sixteen cycles of laundering with bleach and ironing. The excellent resistance of the CEU finish to chlorine bleaching with regard to discoloration is contrasted with results obtained with the two melamine-formaldehyde type finishes studied.

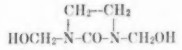
INTRODUCTION

MINIMUM-CARE fabrics, known also as "wash-and-wear," "no-iron," and by similar terms, have become of great importance within the past few years. Although they were originally produced from synthetic fibers, more and more attention has been devoted toward developing cotton fabrics with this important minimum-care quality. The resin industry has made great strides in the direction of furnishing reactant-type resins which will confer the desired properties to cotton. Cotton fabrics of the minimum-care type, equal or superior to the synthetics, have been developed in the past three years and research to create even better cotton products is continuing.

It is well recognized that the comfort of cotton garments is superior to that of man-made fibers, and this property together with the economy of cotton and its durability toward wear and laundering are important factors in its popularity. It is important, of course, that resin-treated, wrinkle-resistant cottons retain these characteristics through the various laundering treatments which may be encountered in the home or commercial laundry establishment.

Of prime importance in resin finishes for wash-and-wear cottons is the ability to withstand home-laundering practices, particularly bleaching with active chlorine bleaches, such as those used in many laundering procedures. In home laundering, the use of sodium hypochlorite in excessive amounts seems to be the rule rather than the exception. As has been pointed out in the literature by a number of investigators, chlorine bleaches cause degradation of cloth which has been treated with nitrogen-containing resins (*1, 2, 3*). Fabrics treated with melamine-formaldehyde resins become yellow. Cottons finished with urea-formaldehyde resins, while not yellowing as badly as with the melamine resins, retain chlorine and are severely degraded by hydrochloric acid formed by heat during ironing. Although it is generally agreed that dimethylol cyclic ethyleneurea (CEU), or more correctly 1,3-bis-(hydroxymethyl)-2-imidazolidinone, is superior to most other nitrogenous resins in resistance to chlorine, contradictory reports have been published on this subject. There have been claims of excellent resistance to degradation by chlorine (*4, 5, 6*). In the latest of these reports, published after the completion of the present work, Bacon, Smith, and Hughes (*6*) point out that a neutralizing wash is highly beneficial if chlorine resistance is to be attained.

Examination of the structural formula of CEU indicates that there is a sound theoretical basis for its resistance to chlorine. The formula of the CEU monomer is:



Obviously, the fully substituted nitrogen should not pick up chlorine from the bleach solution and thus discoloration and degradation should not occur. However, the products of a number of companies vary, particularly with regard to the formaldehyde content of the material furnished or in the method of preparation. Thus, a small amount of free amide may be present as well as some amine from reagents used in the preparation.

Some investigators have claimed that repeated laundering of CEU-treated cotton in the presence of chlorine results in either a loss in wrinkle-recovery angle or in breaking strength of fabric so treated (*7, 8*). In an attempt to resolve this disagreement, studies were initiated at this Laboratory to determine the effect of both home-type and commercial-type laundering on CEU-treated cotton fabrics. The result of a home-type laundering is reported here; a subsequent report will be made on the commercial-type launderings (*9*).

MATERIALS AND METHODS

All fabric samples included in this work were prepared from boiled, bleached and desized 80x80 cotton print cloth, 3.2 oz/sq yd. Impregnation with resin was accomplished by immersion of the fabric in a 9% CEU resin solution containing catalyst followed by passing through pad rolls to remove excess solution. Two dips and two nips were employed with a final wet add-on of approximately 80%. While this investigation is primarily concerned with fabrics finished

[1] One of the laboratories of the Southern Utilization Research and Development Division, Agricultural Research Service, U S Department of Agriculture.

TABLE I

Effect of home-type laundering on cotton print cloth treated with CEU under various conditions of cure

Resin treatment			Breaking strength, warp (lb)				Wrinkle-recovery angle, warp & filling (degrees)				Nitrogen content (%)			
Cat*	Curing temp (°C)	Curing time (Min)	Resin add-on (%)	0 cycle	1 cycle	6 cycles	12 cycles	0 cycle	1 cycle	6 cycles	12 cycles	0 cycle	1 cycle	6 cycles	12 cycles
UTX	140	7	5.1	28.3	29.0	29.5	28.6	282	287	279	280	1.5	1.5	1.4	1.3
UTX	160	4	4.7	29.3	28.3	26.7	27.6	285	287	283	282	1.5	1.5	1.4	1.4
UTX	180	3	4.7	26.7	26.9	27.1	25.4	290	289	289	285	1.5	1.5	1.4	1.4
UTX	180	1.5	5.1	26.7	26.6	26.1	24.2	286	291	289	286	1.4	1.5	1.4	1.4
MX	140	7	5.0	26.3	29.1	29.8	28.7	288	283	285	278	1.4	1.4	1.4	1.3
MX	160	4	4.9	27.2	27.9	28.1	27.5	292	293	285	283	1.4	1.4	1.4	1.4
MX	180	3	5.2	26.2	25.7	26.2	26.3	284	288	289	281	1.5	1.5	1.4	1.4
MX	180	1.5	5.6	27.5	27.2	24.1	25.2	289	288	286	282	1.5	1.5	1.4	1.3
H-7	140	7	5.0	28.7	28.2	25.5	27.7	296	289	283	283	1.5	1.4	1.4	1.4
H-7	160	4	4.7	28.9	27.5	27.7	26.3	291	295	285	293	1.4	1.4	1.4	1.3
H-7	180	3	4.9	26.8	26.1	27.1	25.4	296	289	293	287	1.5	1.5	1.4	1.4
H-7	180	1.5	4.7	26.5	25.7	24.6	26.9	295	286	282	281	1.4	1.4	1.3	1.3
Untreated	—	—	—	44.2	42.5	39.2	34.6	155	162	159	165	—	—	—	—

*UTX = alkanolamine hydrochloride; MX = magnesium salt; H-7 = modified zinc nitrate.

with CEU (Aerotex EU[2, 3]), other samples were prepared for comparison using a methylolmelamine (Resloom HP), a methylated methylolmelamine (Aerotex M-3), and a formulation of CEU containing a thermoplastic acrylic polymer and silicone (5).

Two of the samples were cured by ironing dry from the wet state with a standard electric hand iron at the cotton setting (about 200° C). All other samples were oven dried at 60° C for seven minutes followed by oven-curing at times and temperatures indicated below in the appropriate tables. Three types of catalyst were used with the CEU resin; an alkanolamine hydrochloride (Aerotex UTX and Catalyst AC), an inorganic magnesium salt (Aerotex MX), and a modified zinc-nitrate-type catalyst (Catalyst H-7). The alkanolamine hydrochloride catalyst was used with the methylolmelamine and the magnesium salt was used with the methylated methylolmelamine. All samples were given a three-minute process wash with a commercial home-type detergent, after curing, to remove unbound resin and soluble catalyst. Approximate resin add-on was calculated from the air-equilibrated weight of the fabric. More accurate estimation of resin content was obtained from nitrogen analyses.

All physical testing was performed by ASTM methods, under standard conditions of 70°F and 65% relative humidity. Breaking strength measurements (*10a*) were determined on strips ravelled to 80 threads. Wrinkle-recovery angle was measured on the Monsanto Wrinkle-Recovery Tester (*10b*) using a 500-gram weight. Nitrogen analyses were run by the Kjeldahl method.

In the laundering procedure, two types of home-laundering machines were used. For most of the work, a five-gallon capacity, agitator-type electric washer was used. Approximately one-half pound of cloth was agitated for 20 minutes with five gallons of a 0.1% solution of chip soap (conforming to Federal Specification P-S-566a) containing 0.02% available chlorine from sodium hypochlorite solution. The pH of the resulting solution was approximately 9-10. Following the sudsing, the samples were rinsed twice for three minutes in water at room temperature. An additional study was carried out in a typical home laundry automatic washer. In this washer, approximately four pounds of cloth was washed in 17 gallons of laundering solution at 50°C (122°F). The other conditions approximated those listed above. All samples were ironed dry with an electric hand iron at the cotton setting between laundering cycles.

Chlorine retention was determined iodimetrically by titration of two-gram samples of the bleached cloth with sodium thiosulfate solution in the presence of acidified potassium iodide and starch indicator.

EXPERIMENTAL

REPEATED LAUNDERING——In previous work at this Laboratory (*5*), the remarkable stability of CEU-treated cotton toward a single bleaching, as determined by the "scorch test" (*11*) was demonstrated. In the present work, stability of the resin toward repeated launderings in the presence of chlorine was confirmed. In Table I are shown the results obtained after laundering samples of cloth treated with CEU using three catalysts under four different combinations of temperature and time of cure. Although data were obtained after two and three cycles of laundering, these have been omitted because, as is evident from the table, 12 laundering cycles did not cause any consequential loss of either breaking strength or wrinkle recovery. Furthermore, there was no discoloration or loss of resin. Data on nitrogen content after zero, one, six and 12 cycles are shown.

It is interesting to note that, whereas the breaking strength of the resin-treated fabric is considerably below the control, it retains 97% of its original strength after 12 launderings while the cotton control retains only 78%. Probably the resin-treated cotton has greater resistance to wet abrasion during laundering. The above figures tend to confirm the often-expressed opinion that resin-treated cloth has greater durability to laundering, compared to untreated cotton, than would be expected on the basis of comparative breaking and tearing strengths.

Because Cooke and coworkers (7) had found wrinkle resistance to decrease considerably on washing accompanied by a 50% loss in resin, their work was repeated with CEU resin from the same source, together with the catalysts and conditions of cure specified by these workers. A comparison of the data reported by Cooke, together with the data obtained here using two different catalysts are shown in Figures 1 and 2. It is evident that the fabric samples prepared at this Laboratory were stable to laundering.

Careful consideration was given to the causes of the discrepancy in the data. It was possible that the resins had achieved considerably different degrees of cure, that there was a variance in the composition of the resin used, or that differences in the method of laundering, or a combination of

[2] Throughout this paper, the mention of trade names and firms does not imply their endorsement by the Department of Agriculture over other similar products or firms not mentioned.
[3] Although the results reported herein were obtained with Aerotex EU, previous work, at this Laboratory, has shown equivalent results were achieved with dimethylol cyclic ethylene ureas from other resin manufacturers (*5*).

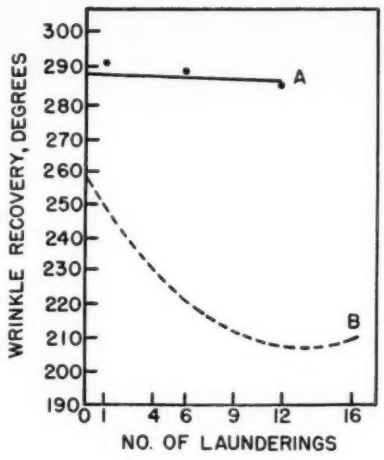


Figure 1

Resistance to laundering and bleaching of fabric treated with CEU using alkanolamine-hydrochloride catalyst, wrinkle recovery (W+F) vs numbers of launderings.

A—5.1% Resin solids, cured 1.5 minutes at 356°F (SRRL data)

B—5% Resin solids, cured 1.5 minutes at 350°F. [Data of Cooke and coworkers (7)]

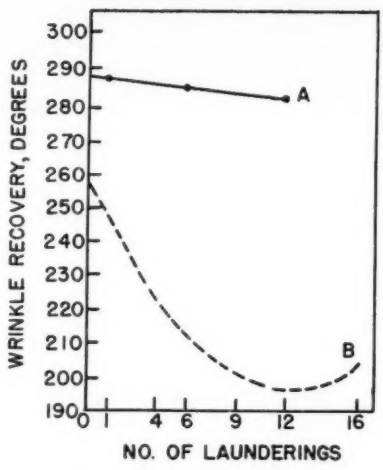


Figure 2

Resistance to laundering and bleaching of fabric treated with CEU using inorganic magnesium salt catalyst, wrinkle recovery (W+F) vs numbers of launderings.

A—5.6% Resin solids, cured 1.5 minutes at 356°F (SRRL data)

B—5% Resin solids, cured 1.5 minutes at 350°F. [Data of Cooke and coworkers (7)]

these caused the disagreement in results.

Through the courtesy of the American Cyanamid Company, Cooke and coworkers furnished resin, catalyst, and cloth together with samples of this same cloth which had been treated with the resin using two catalysts. These materials were used at this Laboratory to prepare samples for testing as before. In addition, the chlorine retentions of these samples were determined. The results are given in Table II. From these figures it can be seen that, once again, the CEU-finished fabrics have remarkable resistance toward the action of active chlorine bleach under the conditions of repeated laundering as carried out in our Laboratory.

Breaking strength, wrinkle-recovery angle and resin content (as indicated by nitrogen analyses) were practically uaffected through 16 laundry cycles.

TABLE II

Effect of repeated laundering of CEU-treated cotton print cloth in an automatic home washer

Property	*Untreated*	*CEU-MX*		*CEU-AC*	
		*A**	*B***	*A**	*B***
Breaking strength (lb)					
0 cycle	51.7	28.2	29.9	27.6	31.7
1 cycle	50.3	28.9	32.3	26.1	29.3
4 cycles	45.0	27.5	30.4	26.3	29.5
9 cycles	44.3	26.6	30.6	28.2	30.8
16 cycles	40.0	27.1	31.3	25.7	28.0
Wrinkle-recovery angle (W + F)					
0 cycle	188	300	279	304	288
1 cycle	191	292	281	297	279
4 cycles	205	291	282	298	279
9 cycles	199	295	283	299	277
16 cycles	202	295	276	294	281
Chlorine retention (%)					
0 cycle	0.000	0.025***	0.028***	0.014***	0.012***
1 cycle	0.003	0.039	0.030	0.017	0.013
4 cycles	0.003	0.054	0.057	0.023	0.024
9 cycles	0.005	0.056	0.059	0.031	0.034
16 cycles	0.004	0.076	0.094	0.030	0.061
Nitrogen content (%)					
0 cycle	———	1.3	0.9	1.3	1.0
1 cycle	———	1.3	0.9	1.3	0.9
4 cycles	———	1.3	0.9	1.3	0.9
9 cycles	———	1.3	0.9	1.3	0.9
16 cycles	———	1.3	0.9	1.3	0.9

*Treated at this Laboratory

**Treated at the laboratories of American Cyanamid Company, Bound Brook, NJ

***These chlorine retention values are due to chlorine picked up during process wash after resin treatment with tap water. The tap water was found to have an available chlorine content of about 10 parts per million.

Although the percentage of chlorine retained increased slightly with repeated launderings, the amounts were almost negligible. The fact that little or no degradation occurred even though the samples were ironed dry after each laundering indicates that this quantity of chlorine has little practical significance.

Although the two sets of samples differed somewhat in initial resin content, it is evident that the durability of the one is equal to that of the other. Therefore, in this particular case, variation due to materials used or the method of curing have been eliminated and any difference in results is probably due to the methods of laundering.

The samples listed in Table I were laundered in a small apartment-size washer; those listed in Table II were laundered in a typical home-size automatic washer. In all cases, samples were ironed dry after each laundering. However, in the work reported by Cooke, samples were not dried between successive launderings. It is probable that this is a contributing factor in the differences observed.

Another source of difference probably lies in variance in the composition of the resin used in the earlier work by Cooke. Early samples of methylolated cyclic ethyleneurea varied considerably in formaldehyde content. Since, theoretically, somewhat less than two mols of formaldehyde per ethylene urea are needed for reaction, there was a tendency to reduce the amount of formaldehyde so as to reduce the amount of formaldehyde fumes given off during curing. However, less satisfactory fabrics were obtained and analyses indicate that the improved CEU resin compositions being sold today generally contain formaldehyde in excess of a 2:1 ratio of HCHO:CEU. Work on the relationship of chlorine retention to composition is presently being carried out at this Laboratory.

CHLORINE RESISTANCE OF MELAMINE-TYPE RESINS——A few experiments were conducted to determine the chlorine resistance of methylolmelamine- and methylated methylolmelamine-treated samples. A commercial CEU formulation containing acrylate and silicone was included also for comparison. The results are given in Table III. Only one set of samples of each of the two melamine resin treatments was run because the cloth was yellowed by the bleach. The methylated methylolmelamine-treated cottons were only slightly yellowed but the methylolmelamine-treated samples were badly discolored. The latter retained 0.15% chlorine after

TABLE III

Effect of home-type laundering on cotton print cloths treated with various resin formulations

Resin treatment				Breaking strength, warp (lb)				Wrinkle-recovery angle, warp and filling (degrees)				
Resin	Cat	Curing temp (°C)	Curing time (min)	Resin add-on (%)	0 cycle	1 cycle	6 cycles	12 cycles	0 cycle	1 cycle	6 cycles	12 cycles	Appearance
CEU	H-7	200*	*	4.7	31.9	29.2	28.3	26.9	278	271	280	269	unchanged
CEU-acrylate-silicone	H-7	200*	*	5.3	33.9	33.3	31.9	29.2	280	274	269	270	unchanged
Methylol-melamine	UTX	150	5	7.4	38.7	36.5	34.1	28.8	267	265	254	254	yellowed
Methylated methylol-melamine	MX	180	3	4.3	33.4	33.1	31.0	29.5	279	267	257	262	slightly yellowed
Untreated	——	——		——	44.2	42.5	39.2	34.6	155	162	159	165	unchanged

* Sample cured from the wet state with an electric hand iron set at 200° C

only wash cycle in the presence of chlorine bleach. White garments so treated with these resins would be unacceptable to the user because of the discoloration. However, in extensive work with melamine-type resins, it has been pointed out a) that the degree of yellowing varies considerably with curing conditions and the type of catalyst used, and b) modification of the melamine resin greatly reduced the yellowing (7).

The data on samples treated with CEU and the CEU formulation (Table III) afford a comparison of the effect of curing with a hand iron [as is done with some garments (5)] with oven-cured samples (Table I). The curing with a hand iron is not quite as efficient as oven curing as indicated by slightly poorer durability toward repeated laundering. The effect of the thermoplastic additives is to give somewhat better tearing strength.

DISCUSSION

When the practical implications of the above-described work are considered, it appears that the CEU finish offers considerable promise for the manufacture of wash-and-wear cotton garments which will withstand the usual home-laundering conditions.

It should not be assumed, of course, that CEU and its formulations represent the last word in textile resins. At the moment, it is superior to most of the other commonly used textile resins for the preparation of wash-and-wear garments which are to be laundered in the home. Urea-formaldehyde, for example, gives good crease resistance and is used in Europe for much wash-and-wear in those countries which do not use chlorine bleaches. There is a large usage in this country on colored cottons which will not have to withstand bleaching. Urea-formaldehyde resins were not considered in the present study because of their well-known tendency to retain chlorine, which later releases acid and causes degradation of the fabric. Similarly, in this work, little was done with the melamine type of resin because of the yellowing produced by chlorine on these resins. There are predictions in the finishing industry, however, that better resins of the melamine and other reactant types are coming soon. Another commercial development, of which much is rumored and little is published, is the use of blends of resins to obtain properties which cannot be obtained by one resin alone.

It should be remembered that the comments on CEU finishes for cotton garments apply only for home-laundering conditions. It is well-known, however, than many resin-treated garments lose much of their wrinkle resistance when they are laundered under more drastic conditions. The effect of commercial laundering will be published in a subsequent report (9).

SUMMARY

In a study made on the effect of home-type laundering on CEU-finished cotton fabric, it has been shown that durability is excellent even in the presence of active chlorine bleach. With time and temperature of curing varying from one and one-half minutes at 180°C to seven minutes at 140°C , no significant differences were noted in the stability of the samples. Similarly, change in catalyst also made little difference in durability toward laundering. Wrinkle recovery, breaking strength, nitrogen content and color were found to be practically unaffected by as many as 16 home-type launderings. The CEU-finished cotton was much superior in resistance toward discoloration by active chlorine bleach than either the methylolmelamine or methylated methylolmelamine-finished fabric included in this study.

ACKNOWLEDGEMENT

The authors wish to express their thanks to McLean George, Margarette Loughlin, and Julia M Sloan for the textile testing, and to Harold P Pastor for the nitrogen analyses reported in this paper. The cooperation of the American Cyanamid Company in this study is gratefully acknowledged.

LITERATURE CITED

(1) Graessley, W, *Textilber* **36**, 459 (1955).
(2) Nuessle, A C, and Bernard, I J, *Am Dyestuff Reptr* **39**, P396 (1950).
(3) Walmsley, L L, *ibid* **46**, P237 (1957).
(4) Howard, J H, *Textile Research J* **26**, 124 (1956).
(5) Reid, J D, Mazzeno Jr, L W, Reinhardt, R M, and Markezich, A R, *ibid* **27**, 252 (1957).
(6) Bacon, O C, Smith, J E, and Hughes, L E, *Am Dyestuff Reptr* **47**, P259 (1958).
(7) Cooke, T F, Roth, P B, Salsbury, J M, Switlyk, G, and van Leo, W I, *Textile Research J* **27** 150 (1957); *Am Dyestuff Reptr* **46**, P585 (1957).
(8) Schroeder, C W, and Condo, F E, *Textile Research J* **27**, 135 (1957).
(9) Mazzeno Jr, L W, Kullman, R M H, Reinhardt, R M, and Reid, J D, manuscript in preparation.
(10) American Society for Testing Materials, ASTM Designation: a) D39-49; b) D1295-53T.
(11) American Association of Textile Chemists and Colorists, "1954 Technical Manual and Year Book" **XXX**, 85, Howes Publishing Co, Inc, New York (1954).

General Calendar

AMERICAN OIL CHEMISTS SOCIETY
Oct 20-22 (Sherman Hotel, Chicago); April 20-22, 1959 (Roosevelt Hotel, New Orleans, La; Sept 28-30, 1959 (Statler Hotel, Los Angeles, Calif)

AMERICAN SOCIETY FOR TESTING MATERIALS (COMMITTEE D-13)
Oct 14-17 (Sheraton McAlpin Hotel, New York, N Y)

DIVISION OF CLOTHING AND TEXTILES IN EXTENSION, TEACHING AND RESEARCH, UNIVERSITY OF GEORGIA
Nov 7-8 (2nd Textile Seminar, Georgia Center for Continuing Education, Athens, Ga)

DRUG, CHEMICAL & ALLIED TRADES SECTION, NYBT
Sept 11-14 (Annual meeting, Sagamore Hotel, Bolton Landing, Lk George, NY)

THE FIBER SOCIETY
Sept 9-10 (Montreal, Que); April 29-30, 1959 (Fontana Village, NC)

INSTITUTE OF TEXTILE SCIENCE
Sept 8 (Sixth Scientific Session, McGill Univ, Montreal, Que)

INTERNATIONAL TEXTILE MACHINERY EXHIBITION
Oct 15-25 (Belle Vue, Manchester, England)

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
August 25-29 (Summer course in "The Mechanics of Textile Structures")

NATIONAL COTTON COUNCIL OF AMERICA
Oct 1-2 (Chemical Finishing Conference, Washington, DC)

SOUTHERN TEXTILE EXPOSITION
Oct 6-10 (Greenville, SC)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
Luncheon meetings at the Hotel Roosevelt, New York, NY: Sept 9, Oct 8, Nov 12

Proceedings of the

American Association of Textile Chemists and Colorists

Copyright, 1958, American Association of Textile Chemists and Colorists

July 28, 1958

Southeastern Section———

WASH-WEAR RESINS FOR WHITE COTTON FABRICS*

HECTOR C BORGHETTY[1]

The speaker interrelates the testing of crease-resistant cotton fabrics with their actual performance under severe laundry conditions. He traces the development of the new chlorine-resistant resins that have had such recent spectacular success in the white shirting field and discusses the difficult conditions encountered in applying these resins.

The temptation to use the older resins to meet these requirements has led to failures attributed to chlorine retention with subsequent severe yellowing and complete destruction of the shirts. The AATCC Chlorination Test 69-1952 does not in itself differentiate between marginal resins, but it can be suitably modified to serve as a supplementary test procedure. A test used extensively in the household is suggested for testing resins on cotton dress goods. It is based on AATCC 36-52, which has been in use for many y ars for testing of dyestuffs.

The qualifications that set apart crease-resistant finishes from wash-wear qualities are also emphasized, together with the concept of washfastness. New resins that show little or no chlorine damage are also discussed.

INTRODUCTION

THE successful development of chlorine-resistant resins has finally made possible the treatment of white cotton fabrics destined for shirts. This has been the most difficult of all resin-finishing problems because of the severe conditions encountered in commercial laundries. When urea-formaldehyde resins were first introduced thirty years ago, they were applied to white shirts and found unsatisfactory in durability to alkaline washing and in their resistance to chlorine damage required for American laundry processing.

The problem has now been solved by the concerted and highly organized efforts of the shirt manufacturers, resin producers and the textile-finishing industry. This effort led to an amalgamation of knowledge and techniques that made possible the correct selection of resins, control of their application and the optimum type of fabric required. The shirts were then tailored to give no puckering at the seams or ruffling of the collar and cuffs. The white wash-wear shirt that results can be given a light wash and rinse and then allowed to dry on a hanger as customary for a shirt made from a synthetic hydrophobic fiber.

DISCUSSION

WASH-WEAR ——— The term "wash-wear" is subject to many interpretations and much confusion. This paper defines the term as applicable to "a cotton garment that will drip-dry without creases and require minimum care." Minimum ironing is considered to signify that many casual wearers are satisfied with the appearance of the garment without any ironing, while more fastidious ones will insist on touch-up ironing at the seams and pockets. Under any circumstance, the treated fabric should respond readily to *cool* ironing on the *dry* fabric.

The wash-wear quality differs from standard crease resistance mainly as a matter of degree. Wash-wear fabrics must maintain crease-recoverable character after many washings; whereas, a standard crease-resistant finish need not be durable to washing. The wash-wear treatment should possess wrinkle recovery in the wet state to enable the creases to move out of position during the evaporation of the moisture. This characteristic of good wet crease recovery is best imparted by a few resin types that combine or react with the chemical groups of the cellulose and become an intrinsic part of the fiber, rendering it hydrophobized and therefore less apt to wet and swell and more able to dry quickly. These resin types are also those that possess greater durability to washing and thus are doubly advantageous. The hydrophobizing quality imparted to cotton by the resin permits the fiber to act in an entirely new manner; treated cotton is no longer, strictly speaking, cotton. It is rather, a modified fiber having many of the highly desired qualities of the man-made fibers. Hydrophobic cotton dyes less readily, absorbs moisture slowly and has a lower regain. It also acquires some of the drawbacks of the man-made hydrophobic synthetic fibers and is slightly less comfortable to wear. This fact should be given consideration when selecting fabric constructions for comfort of the wearer. Open spaces in the weave can be used to reacquire any loss of porosity caused by the resin treatment. Wash-wear fabrics should be selected preferably with full consideration of their specific suitability for each end use.

If wash-wear is defined according to the terminology given above, it naturally follows that the durability of the resin to washing is a prime requisite for a wash-wear cotton, hence testing of the garment should include a sequence of multiple washings. Many resins lose the majority of their drip-dry character after five or six household machine washings and this is not considered sufficient to warrant the labeling of a garment as "wash-wear".

DURABILITY OF RESIN TREATMENT———Having introduced the concept of durability into the testing of resins on cotton fabrics, we may consider how durability can be of a greater or lesser degree according to the end use of the garment. Chemical manufacturers have capitalized on the end-use requirements of garments when they introduced the cyclic urea

* Presented April 19, 1958 before the Southeastern Section in Thach Auditorium of Alabama Polytechnic Institute, Auburn, Alabama.

[1] Formerly with Rohm & Haas Co. Present address: 1406 Rockwell Rd, Abington, Pa.

resins, which made possible the first major use of crease-resistant finishes for cotton in the USA.

CREASE RESISTANT RESINS SUITABLE FOR COTTON FINISHING——The cyclic urea resins made possible the large-scale treatment of cotton dress goods because of their good washfastness, coupled with sufficient chlorine resistance to meet all household requirements of chlorination washing. These resins were available in 1949 but were not applied in quantity yardage until 1952. Since then it is estimated that several billion yards of dress goods have been processed with ethylene urea types alone, with an insignificant number of complaints. The reason for the success of ethylene-urea resins versus urea-formaldehyde types is shown in Table I.

The history of success of DMEU on cotton fabrics processed in large volume since 1952 can neither be overlooked nor easily surpassed. The ethylene-urea resins were selected for use on cotton dress goods on the basis of their outstanding behavior compared to urea- and melamine-formaldehyde resins, when evaluated according to practical household washing conditions. As yet, there is no brief accelerated laboratory test that can be used to simulate washing conditions in the home or the commercial laundry, and it is therefore necessary to use the multiple-washing technique currently employed by manufacturers of soap, detergents and household bleaches. Multiple washes have proven very reliable to evaluate colorfastness, soil-retention, efficiency of detergency, degree of whiteness retention, as well as resistance to chlorine. Multiple washes that simulate household practice do not employ an antichlor and therefore limit the chlorine content to the minimum amount for maximum effect. An excess is neither necessary nor helpful; it would leave an obnoxious odor of chlorine that the housewife would not tolerate. This technique received universal approval some years ago when the large soap and dyestuff manufacturers cooperated to develop the optical bleaches that have been widely used to give a brilliant white. The vast majority of soaps and detergents used in the household contain a small, but very effective percentage of a colorless fluorescent dye that is stable to chlorine bleach. In using the multiple washes, the cooperating laboratories were able to determine the stability and efficiency of the optical dye to chlorine as well as its substantivity for textile fibers.

TABLE I
Treatments on 80 x 80 white cotton fabric

	Tensile strength in pounds (warp)		
	Initial	*After 10 washes*	*After 10 washings followed by one scorch at 365° F for 30 sec*
20% — UF resin (60% paste)	33	8	0
10% — Dimethylol ethylene urea (50% DMEU)	31	31	25
— Water control	44	40	40

The 10 washings were made with chlorine as given in Table II.

Note: The UF resin is so sensitive to chlorine retained that it damages the cotton fiber during the drying process. The DMEU shows no damage whatever during drying or normal ironing. It shows about 19% if given an exaggerated scorching for 30 seconds at 365° F after the fiber has already been dried.

CHLORINE WASH TEST——The multiple wash test used extensively in the industry has been widely disseminated to the household because it appears in a slightly modified form on the label of the Clorox (*1*) bottle. The test in its entirety can be carried out as shown in Table II.

TABLE II
Household chlorination wash test

Give consecutive washings, with intermediate drying and pressing, through a detergent solution of:

0.15%—Built alkaline household detergent (Tide (*2*)—Fab (*3*), etc)
0.02%—Available chlorine (This corresponds to one-half oz of Clorox per gallon)

Run for 15 minutes at 140° F at bath ratio of 1:20 (fabric to solution). Rinse, press/dry at 300° F

Repeat this test twenty times and check the durability of the crease recovery, wash-wear, and the effect of tensile and tear strength, plus any other properties according to end use requirements.

The AATCC Standard Test Method 36-1957 (IV) closely resembles this household test excepting for temperature (182°F) and time. It is listed in the *1957 Technical Manual and Year Book* under the name "Wash Test for Characterization of Textile Colorants", pages 94-5. It is listed in earlier *Year Books* under the name "Colorfastness to Commercial Laundering and Domestic Washing" as follows:

Year	*Page*
1952	83
1953	91
1954	83
1955	56
1956	79

AATCC 36-52 was based on commercial laundry and household experience and has been used for many years to determine the effect of washing and chlorine on colors. For some reason, this test is no longer given its true perspective among the various test methods in the *1957 Year Book*, and it has been supplanted for the testing of chlorine damage by AATCC 69-1952 ("Damage Caused by Retained Chlorine", page 121, *1957 Year Book*). This latter test has become a prevalent one for the evaluation of resins for cotton and is causing much dissatisfaction because of the inconsistencies that have arisen among various laboratories and finishing plants. AATCC 69-52 stipulates greatly exaggerated amounts of chlorine (50 times more on weight of fiber than AATCC 36-52). It is an accelerated laboratory method designed originally as a "yes/no" chlorine absorption test. The amount of chlorine given when transposed to a household washing machine becomes ½ gallon (64 ounces) of Clorox to 10 gallons of washing solution; whereas, the Clorox recommendation is five ounces to 10 gallons. AATCC Standard Test 36-57 would correspond to two and one-half ounces of Clorox to 10 gallons.

If AATCC chlorine concentration of 69-52 is recalculated for the actual amount on the weight of fiber for the specified 1:50 bath ratio, a concentration of chlorine equal to 12.5% is obtained. When it is remembered that nitrogenous resins impart affinity for chlorine, it follows that the concentration of this chemical is extreme.

Had this test acquired universal acceptance prior to the advent of ethylene-urea resins, no finisher would have attempted their application to cotton and few wrinkle-resistant dress goods would have reached the consumer. The success of the billions of yards satisfactorily merchandised with ethylene-urea resin finish contradicts any evaluation of these resins by 69-52. Test methods are designed for speed in laboratories, but they should remain realistic and correspond to end-use requirements. Often chemicals that are effective and safe in minor concentrations become harmful when the concentration is multiplied by a factor of 25 to 50 merely to speed up the evaluation procedure.

AATCC 69-52 is so drastic that many vat dyes that have had success-

ful application for thirty years on printed and woven cotton fabrics will show 30%-40% tendering of cotton because of their chlorine retention; whereas, no loss whatever is recorded in actual use or by the household chlorination test given in Table II.

AATCC 69-52 for chlorine damage has stimulated so much interest that many laboratories have sought methods to up-grade the resin resistance to chlorine by adding buffers based on magnesium and zinc salts. These act as catalysts during curing of the resin and then remain in the fabric in the form of either oxide or hydroxide, which are able to neutralize the hydrochloric acid evolved during the scorching period of the test procedure. The test does not comprise any prior washing; therefore, it often results that the metal salt catalyst has upgraded the resin to a point that it no longer shows fiber tendering. The importance of realistic testing is vividly evidenced here. In fact, an alkaline wash at high temperature will remove any transitory buffering of the magnesium or zinc oxide and reveal the true chlorine resistance of the resin. The problems of chlorine damage needs solution by means that are washfast for these cotton fabrics subjected to commercial laundering.

COMMERCIAL LAUNDERING——The conditions encountered in the laundering of white cotton shirts and sheetings in commercial establishments bears little severity of relationship to washing in the household. Contrary to current belief, the concentration of chlorine used by laundries is not the contributing cause of the breakdown of fabrics. In fact, commercial laundries have had the advantage of scientific advice from the nonprofit American Institute of Laundering, and use minimum chlorine concentration that corresponds to two and one-half ounces Clorox per 10 gallons, which is equivalent to 100 ppm chlorine. The commercial laundry bath ratio is also lower and therefore the amount of chlorine on the weight of fiber is further reduced in proportion to, and in favor of, the fiber.

The severity of commercial laundering is really a consequence of high temperature (160°), prolonged time (30 minutes), and the final acid sour at pH 5.0, dried into the cloth. All these conditions contribute to removal by chemical and mechanical breakdown of the resin treatment and to the opening of the chemical linkage that becomes sensitive to traces of chlorine. This explains why resin manufacturers and finishers have cautiously labeled their materials that are subject to commercial laundering—"Do Not Use on White Shirtings or Sheetings." The type of laundering they refer to is illustrated by the standard commercial laundering formulation shown in Table III.

TABLE III

American Institute of Laundering washroom formula for white family work

Operation	Time (min)	Temp. (°F)	Supplies
1—Suds	6	130	built soap and alkali
2—Suds	6	160	built soap
3—Suds	6	160	built soap
4—Bleach	8	150	bleach solution (100 ppm chlorine)
5—Rinse	2	160	water
6—Rinse	2	160	water
7—Rinse	2	160	water
8—Rinse	2	130	water
9—Rinse	3	100	bluing solution
10—Sour	3	100	sour to pH 5.0

RESINS THAT WITHSTAND CHLORINATION——The problem of synthesizing resins that will not absorb chlorine can be solved by using nonnitrogenous resins or nitrogenous resins that contain a self-buffering chemical group. Resins of either type are new to the textile industry and are being successfully field tested on white cotton shirts on a large production basis. So far, it appears that no tendering of the fiber results. On the other hand, however, it has become quite evident that, while these resins can be processed through many commercial launderings without damage to the fiber, they will lose their wash-wear effect because of mechanical and chemical removal from the fiber itself. This leads us to state that, while the chemical problem of chlorine damage can be solved by adopting nonnitrogenous or even special nitrogen-containing resins, nevertheless the resistance of the wash-wear effect to commercial laundering is still far from satisfactory. Competent finishers have recognized this and stipulate that their wash-wear chlorine-resistant resins are intended for household machine washing or drip-dry techniques only. They offer the chlorine resistance as an added bonus in case the consumer decides to send the shirt to a commercial laundry. It is thus implied that the garment is wash-wear and continues to be such after twenty or thirty mild washings at home. It will go through commercial laundering without fiber damage, but it will no longer be wash-wear after such laundering. In compensation for the loss of wash-wear character after a few commercial launderings, it must be noted that the muss resistance, soil resistance and ease of ironing will remain for twenty to thirty commercial launderings. This resistance of the hydrophobic treatment would, in the opinion of many users, justify the use of chlorine-resistant resins apart from its initial wash-wear character.

REASON FOR DROP OF WASH-WEAR CHARACTER DURING COMMERCIAL LAUNDERING——As stated under the heading on wash-wear, the definition of durability to washing is inherent to the wash-wear effect. A treated fabric should maintain its ability to smooth out, during the air drying period, after twenty to thirty drip-dry washings; however, commercial laundries subject white shirts to a combination of chemical and mechanical treatments that bear a greatly increased ratio of severity to drip-dry washings. This relationship is roughly:

one commercial white laundry is equivalent to 20 drip-dry washings.

The durability of wash-wear effect is more difficult to achieve on cotton shirting simply because of the severity of commercial laundering. Wash-wear is a function of:

1) Type of resin used.
2) Durability of resin to alkaline wash.
3) Durability of resin to chlorine bleach.
4) Durability of resin to high temperature.
5) Amount of resin present.
6) Resistance to repeated acid sour.

The curve in Figure 1 illustrates the relationship between durability to commercial laundering of the wash-wear rating measured by AATCC 66-1956, page 158 of the *1957 Year Book*, compared to the durability of crease recovery. The wash-wear rating is given according to the method by Lawrence and Phillips (*4*).

A satisfactory initial wash-wear rating of 3+ should withstand twenty drip-dry washings without dropping below 3; any rating below 3 automatically takes a garment out of the wash-wear classification. Figure 1 shows how, after five commercial launderings, a wash-wear rating drops to 2½, while the fabric initially had a rating of 4.

The main contributing factor in maintaining the wash-wear rating is the resistance to washing of the hydrophobic effect of the resin. The crease recovery will often show good durability because the crease mechanism is not always necessarily directly related to the hydrophobizing effect of the fiber.

SELECTION OF RESINS FOR WHITE SHIRTINGS AND SHEETINGS——Complete durability of wash-wear to commercial laundering cannot be fully guaranteed with any known type of resin at present available, as shown in Figure 1. The only means of merchandising a white shirt or sheet is to do so through a controlled labeling program which specifies that the material is "wash-wear" provided it is simply drip-dried or household washed. Even such a restricting label will not eliminate the possibility that the garment will not eventually be sent to a commercial laundry. For this eventuality, it is important to use resins that are resistant to chlorine damage under repeated treatment. The life of a good untreated broadcloth shirt will allow it to carry through 40-50 commercial launderings without damage to the fabric. This same resistance is desired in a resin-treated fabric, and it can be obtained by using nonnitrogenous resins or some of the newer cyclic types.

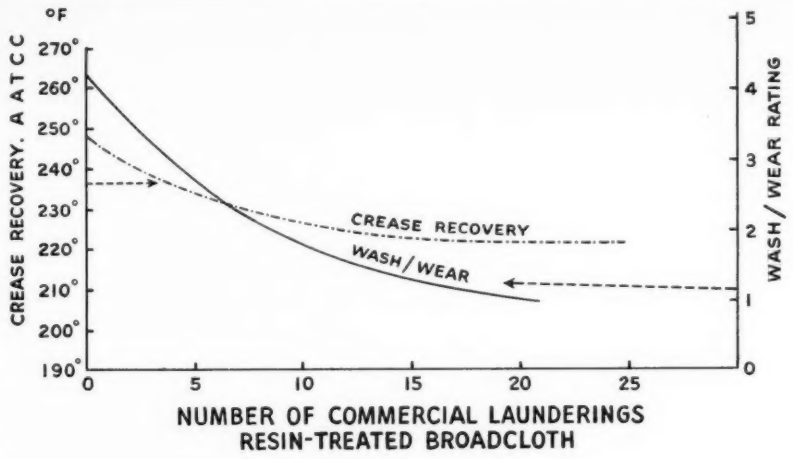
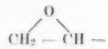


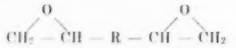
Figure 1

NONNITROGENOUS RESINS——Two separate types are now available; namely, the acetals and the epoxides. The former are polymeric condensates of alcohols and aldehydes and are best described as reactants able to crosslink cellulose to give durable crease resistance, hence wash-wear effects. They often are formaldehyde carriers and avoid excessive volatilization of the reactant and damage due to highly acidic catalysts. These resins are quite recent (5) and are being field tested on white fabrics.

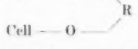
EPOXY RESINS——The second group of nonnitrogenous resins is also of very recent synthesis (6) and is typified by the epoxide or epoxy group:



Two of these, at least, must be present in order to give a difunctional molecule; eg,



able to react with cotton to crosslink adjacent cellulose chains,



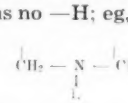
and render the fiber hydrophobic and of durable wash-wear effect.

The high cost of the epoxides and their lower relative crease resistance do not allow them to meet current requirements for cotton, and these resins have, therefore, not yet appeared on the market in volume fabrics. These drawbacks can, however, be overcome by careful blending (7) of epoxy resins with dimethylol ethylene urea to give combinations that answer the most stringent specifications for wash-wear, low chlorine-damage treatment on white cotton fabrics. The combination of the two resins has a synergistic character that imparts higher wrinkle resistance than would be expected from either reactant resin alone (8). A ratio of three parts DMEU resin solids in bath to seven parts diepoxide used with zinc fluoborate catalyst gives stability to commercial chlorination laundering and is shown in Figure 1. The durability of wash-wear effect to drip-dry or household machine washing is also excellent. The durability of wash-wear to commercial laundering is fair, but the durability of crease resistance and ease of ironing is satisfactory even after 10-20 commercial launderings.

CHLORINE-RESISTANT NITROGENOUS RESINS——A new group of nitrogenous resins classified as cyclic ureas has recently been introduced under the name of triazones. They contain an extra N in the ring and differ in this respect to the cyclic DMEU which they otherwise closely resemble.

The durability of the triazones to commercial laundering, to acid hydrolysis, and to chlorination washing is not outstanding, but they have the great advantage over former cyclic urea derivatives of showing little chlorine damage on commercial or household washing. The introduction of wash-wear with mild washing only has made practical the adoption of these new cyclic resins for shirts. Their wash-wear effect after three or five commercial launderings is low but they still possess ease of ironing and good muss resistance after 10-20 commercial launderings. Their damage to the cotton fiber during commercial laundering is below 10%, and this is considered sufficient to classify them as satisfactory. This loss may occur after one or three commercial chlorination launderings and is not necessarily cumulative because the resin tends to be gradually removed

The tertiary nitrogen is characterized by substitution with alkyl groups only and has no —H; eg,



This is enclosed in a ring to which reactivity to cellulose fiber is imparted by the presence in the same molecule of activated methylol groups attached to urea. The triazone resin thus has a built-in buffering mechanism that allows the tertiary nitrogen to neutralize any hydrochloric acid evolved during the chlorination treatment. This buffering mechanism is lasting or regenerative each time the fabric is washed in alkali or soap. The protection is far superior to that referred to before in reference to metal salt catalysts, and the success of these new cyclic resins bears out the theory outlined. One of the weaknesses of these resins lies in the difficulty of removing the odor of methylamine from the treated fabric. The manufacturing process for the triazones and the curing treatment permits the evolution of this odor; whereas, cyclic ethylene urea resins are almost free of this inconvenience. The odor can be

(*concluded on page P523*)

Washington Section———

RECENT DEVELOPMENTS IN THE CHEMICAL FINISHING OF TEXTILES*

FRED FORTESS
Manager, Dyeing & Finishing Laboratories
Celanese Corp of America
Charlotte, NC

Following the introductory material, in which the wide variety of objectives in finishing are outlined, the author discusses the following topics:

1) Aspects of "ease of care" finishing of cotton and rayon.

2) The chemistry of the silicone finishes and the resultant fabric properties.

3) Special use of alkaline treatment for finishing hydrophobic fibers.

4) New chemicals available for chemical finishing.

INTRODUCTION

THE ever-increasing importance of chemical and mechanical treatment of fabrics for the achievement of improved aesthetic and functional effects has led to the gradual separation of the dyeing from the finishing responsibilities in the modern dyehouse. Whereas dyeing has coloration as its major purpose, finishing has a wide variety of objectives. These may include the following:

1) To improve such aesthetic properties as hand, drape, luster, and texture, not fully achieved without finishing because of fiber composition and construction limitations.
2) To impart specific functional properties not inherent in the fibers composing the fabric or in the fabric geometry or construction. These properties include water repellency, fire retardancy, soilage resistance, or simple surface lubricity to improve sewability.
3) To improve the "ease of care" properties of the finished garments so that less attention is required in washing or drycleaning and little ironing is needed. On cotton and rayon fabrics, resistance to dry and wet wrinkling, shape retention, and stability are achieved by internal chemical reactions. On the thermoplastic man-made fibers, improved ironing properties and shape retention are achieved by heat setting and the creation of nonsticking surfaces.
4) To improve the durability of garments by improving abrasion resistance, tear strength, and resistance to weathering and destructive biological action.
5) To permit the greater adaptation of existing fabric constructions to changing market needs.

When only the natural fibers, ie, cotton, wool, silk, and linen, were available, and then mostly as 100% fabrics, the problems of finishing were relatively simple and chemically quite limited. The introduction of at least six completely dissimilar man-made fibers during the past thirty years and their large-scale use in blends with cotton and wool has greatly complicated the achievement of the many finished fabric properties required by the current customer.

In the present textile market, the emphasis in merchandising appears to be on achieving a balanced performance and economical fabric with at least one promotable feature in the finished garment. However, for each particular end use, especially in apparel fabrics, a large number of additional properties must be considered, and no significant deficiencies are permissible. Stoll (*1*), in a chapter "End Use Requirements versus Fiber Properties", listed nine major classifications of end-use requirements for textile materials. Table I outlines these factors which include various aspects of both aesthetic and functional properties.

More recently Barach, Stoll, and Tesi (*2*) have concerned themselves with predicting the commercial acceptance of a new fiber and have analyzed the minimum performance requirements related to "ease of care" fabrics going into washable garment applications. These are listed in Table II. To achieve a balance of these properties and still attain proper hand and appearance requires a careful utilization of fiber, yarn, and fabric composition and construction in conjunction with the finishing treatments.

TABLE II
Ease of care properties

Dimensional stability
Wrinkle resistance (dry & wet)
Crease retention—pleatability
Ease of laundering & drying
Ease of ironing
Appearance after washing & drying
Retention of appearance

A breakdown of some of the factors required to provide adequate durability and general properties of fabrics is presented in Table III. In every instance, including such diverse properties as soilage resistance or ease of soil removal, sewability or seam strength, and ease of ironing or glazing resistance, the type of chemical finishing treatment used will either improve or decrease at least one other

TABLE III
Durability & general performance

Strength
Wear resistance
Pilling resistance
Chemical & photochemical resistance
Glazing & heat resistance
Fire resistance
Sewability & seam strength
Ease of pressing & forming
Soil resistance & ease of soil removal

TABLE I
Classification of end-use requirements of textile materials

Aesthetic appeal Ease of handling Form stability Physiological requirements Special functional requirements	Functional characteristics determining appeal, suitability, adaptability
Retention of aesthetic appeal Resistance to chemical degradation and disintegration Resistance to mechanical fatigue and wear Ultimate strength and resistance to fortuitous wear and tear	Characteristics determining durability and wear resistance

* Presented before the Washington Section on April 11, 1958.

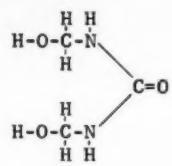
performance characteristic of the fabric. This multiplicity of effects will be described in some detail in the discussion of the silicone finishing of fiber surfaces.

Although it is relatively easy to describe the objectives of mechanical and chemical finishing, it is much more difficult to correlate the chemical and physical changes which occur in and on the fiber with the performance characteristics of the finished fabric or garment. It has been possible to greatly improve the dimensional stability and wrinkle performance of cotton and rayon fabrics by chemical treatment. The many chemical finishes developed for this purpose can be easily evaluated by simple washing and wearing trials. However, after thirty years of commerical use of this type of finishing, we still have only an imperfect understanding of the chemical and physical changes which occur in the fiber. As a result of this lack of basic information, the further improvement in finished fabric properties and the development of new reactive chemicals are carried out largely on the basis of empirical and costly development work.

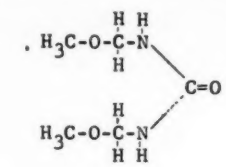
To facilitate the development of new chemical treatments for the achievement of specific effects, a more complete knowledge of the site of the chemical reaction and the resultant influences on the fiber, yarn, and fabric properties is required. Valko (*3*) has emphasized for many years the importance of applying fundamental scientific methodology to the problems of textile chemistry. In an attempt to systematize our present knowledge, he has directed attention to the relationship between the measured desired properties of the finished fabric and the possible location of the chemicals within. on, or between the fibers. Table IV illustrates the analysis of a number of finishing effects as related to site.

TABLE IV
Site of deposition in finishing processes

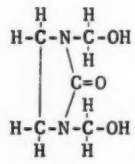
Desired effect	*Desirable site*	*Attained site*
Crease resistance	intrafiber	intrafiber
Softening	interfiber	interfiber
	surface	
	interyarn	interyarn
Water repellent	interfiber	interfiber
	surface	interyarn
Antislipping	interyarn	interyarn
	surface	interfiber
Dimensional stabilization of rayon	intrafiber	intrafiber interfiber
Shrinkage control of wool		
a) Resin treatment	interfiber	interfiber
b) Chlorination	intrafiber	intrafiber
Improved sewability	interyarn	interfiber
	surface	interyarn
Increased bodying	intrafiber	interyarn
	interfiber	interfiber



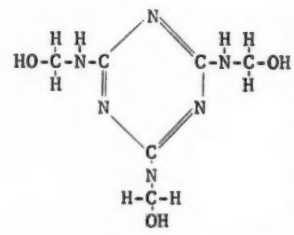
Dimethylol Urea



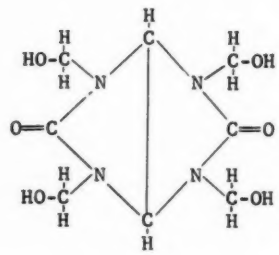
Dimethyl Methylol Urea



Dimethylol Cyclic Ethylene Urea



Trimethylol Melamine



Tetramethylol Acetylene Diurea

Figure 1
Structures of typical reactants for cotton and rayon

The possibility of assigning the exact distribution of the chemical finish is not simple, particularly on cotton and wool fibers whose internal structure is still incompletely understood. Our knowledge of the effect of finishing chemicals would be greatly enhanced if we knew more about the exact state of the chemical at its location in or on the fiber. For the purpose of simplicity, we have considered any reaction or deposition of chemical materials within the individual fiber as beng intrafiber, rather than attempting to describe a submicroscopic location between fibrils, micelles, or internal surfaces. While some chemicals react with functional groups in or on the fiber, others may be simply deposited in an unchanged or a polymerized form in or on the fiber. The problem of properly assessing the mechanism by which fabric properties are modified by chemical finishing is greatly complicated by the fact that we are applying chemicals, but are usually measuring the resultant effect by physical properties.

It is not always possible or desirable to separate the chemical finishing treatment from the specific fibers being modified or from the performance properties being achieved. In this paper we will take a three-dimensional view of the following topics:

1) Aspects of "ease of care" finishing of cotton and rayon.
2) The chemistry of the silicone finishes and the resultant fabric properties.
3) Special use of alkaline treatment for finishing hydrophobic fibers.
4) New chemicals available for chemical finishing.

"EASE OF CARE" FINISHING OF COTTON AND RAYON FABRICS

Although the "wash and wear" label or slogan is being widely used, in this paper we shall consider that the attainment of a finished garment prepared from a woven fabric which can be washed and dried even by selected procedures and still look as fresh and as crisp as a properly ironed garment is a desirable ideal, which has been only imperfectly attained. We shall avoid a great deal of semantic difficulty and consumer disappointment if we use "ease of care" or "minimum care" and include touching up with an iron. Our definition of "ease of care" finishing required that an improvement is achieved in all or most of the seven properties listed in Table II.

The use of a variety of formaldehyde-reactant chemical compounds for the treatment of cotton and rayon fabrics is familiar to most of us and probably represents the greatest achievement of the finishing phase of the textile industry during the thirty years that they have been applied commercially. Notable progress is still being made by modifying the composition and structure of the original simple urea- and melamine-formaldehyde derivatives. In Figure 1, several typical structures of these reactant finishes being applied commercially are described. These include the newer cyclic ethylene-urea and the acetylene diurea, as well as the methyl ether derivatives of standard UF and MF compounds.

A vast body of practical experience is now available to the commercial finisher, in large part due to the technical efforts of the textile-chemical suppliers. This has resulted not only from their effort to improve the competitive position of their specific products, but also from the need to achieve a higher degree of "ease of care" performance required for the present consumer market.

However, even with all this apparent progress, there is a growing realization that a more basic understanding of the reactions which go on in the fiber and the effect of these changes on the mechanical properties of the fiber is essential to make further improvements. Nuessle, et al (*4*) recently summarized some of the controversial aspects of chemical finishing of cellulosic fabrics for improved crease resistance. They included such problems as:

1) An explanation of the difference in the way in which cotton and viscose rayon respond to UF and MF chemicals,
2) The relative contribution of cross-linking versus self polymer formation, and
3) The effect of surface versus internal resin formation.

Steele and Giddings (*5*) have concerned themselves primarily with the effect of urea-formaldehyde reactants upon the plasto-elastic behavior of fibers in terms of elasticity, retarded elasticity, and plastic flow. They present evidence that dimethylol urea, properly catalyzed, produces a cross-linked fiber insoluble in the standard copper solvents for cotton. Cooke, et al (*6*), using melamine-formaldehyde, also concerned themselves with the effect of chemical treatment upon the elastic properties of the resultant fiber.

In most of the recent work, a direct correlation is made between the effect of the reactive chemicals and the increased ability of the fiber to both resist and recover from wrinkling. Cameron and Morton (*7*) were among the first to propose the hypothesis that these formaldehyde reactants produce cross links. However, in 1956, Morton stated as part of a discussion of Alvsaker and Turner's (*8*) paper that "The evidence for cross linking of cellulose in the U-F process . . . is purely inferential. . . ." We must now take the position that at least two separate effects are occurring within the fiber; 1) the cross-linking reaction, which is measured by cuprammonium hydroxide insolubility and accounts for the reduced swelling, and therefore improved resistance to fabric shrinkage on washing, and 2) an internal polymer formation (in addition to cross linking) which involves a major portion of the reacting chemical and which produces the high level of both dry and wet wrinkle resistance and accounts for the "drip-dry" and "ease of care" properties of finished cotton and rayon fabrics.

In reference to the observations made above, it should be noted that as little as one percent cyclic ethylene urea-formaldehyde efficiently reacted within the cotton or the rayon fiber will produce shrinkage resistance and insolubilization of the fiber. A significant improvement in dry wrinkle performance can be achieved with three to four percent cyclic ethylene urea-formaldehyde. However, dry and wet wrinkle performance suitable for "ease of care" washable properties, ie, requiring little or no ironing, requires five to six percent of this reactant. We are still not sure whether this progressive improvement in performance properties is due to an increased number of cross links or an increased proportion of internal polymer.

Gagliardi (*9*) and others have brought to our attention the wide variety of catalysts available for the condensation reaction of the various formaldehyde reactants noted in Figure 1. These include ammonium salts of strong acids, alkanolamine salts of strong acids, dicarboxylic acids, such as oxalic and tartaric, and more recently, such metallic salts as magnesium chloride and zinc nitrate. In special instances, such as when epoxy compounds are used in conjunction with the formaldehyde reactants, strong Lewis acids, such as zinc fluoroborate, have been used. Since the various catalysts seem to behave differently with the different compounds listed in Figure 1, it can be anticipated that, by careful choice of catalyst, formaldehyde reactant, and curing conditions, it may be possible to control the ratio of cross linking to fiber substrata and self-polymerization.

Smith's (*10*) work, comparing the effect of one to fourteen percent total reactant solids on unmercerized, semimercerized, and mercerized cotton with nine different reactants and only one catalyst, ammonium thiocyanate, illustrates the complexity of determining optimum reactant, most efficient catalyst, and properly prepared fabric.

At this time, the practical problem which still confronts us is how to attain all of the desirable properties of "ease of care" fabrics with a minimum loss of tensile and tear strength, particularly on cotton, and the elimination of chlorine retention and the resultant fabric tendering.

No discussion of current developments in "ease of care" finishing can be complete without mention of the attempts to apply these finishes to cotton garments in the cutter's plant or in the drycleaning establishment. This approach was initiated through the technical activities of the National Cotton Council and has been intensively studied in the laboratories of the Southern Utilization Research and Development Division of the Department of Agriculture. Reed et al (*11*) made a preliminary report of this garment treatment, and Graham (*12*) discussed in some detail the application of cyclic ethylene urea-formaldehyde, thermoplastic acrylic polymer, silicone, or polyethylene emulsion, zinc nitrate catalyst, finishing formulations to shirts and slacks. Curing and washing resulted in ex-

cellent shape retention and much less seam pucker than normally observed on "wash and wear" garments prepared from fabrics treated with this type finish. Such problems as proper handling of the garments during curing, odor formation, effective curing of the resin, and resetting of pleats and cuffs remain to be worked out.

SILICONE POLYMERS IN TEXTILE FINISHING

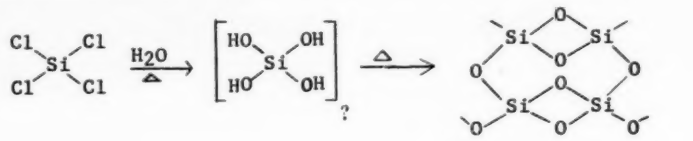
In contrast to the use of the formaldehyde reactants, the silicones represent a relatively recent development. However, the rapid conversion of selected silicone polymers from the category of expensive laboratory curiosities to that of standard textile-finishing chemicals being applied to millions of yards of fabric, including cotton, serves to illustrate the willingness and the ability of the textile industry to adopt new chemicals with the cooperation of the chemical industry.

The adaptation of siloxane chemistry for the production of a relatively linear, liquid polymer containing reactive groups for subsequent further polymerization on the fabric is a notable achievement worthy of detailed discussion. Rochow (*13*), McGregor (*14*), and Reed (*15*) have described the chemistry of silicon as applied to the development of useful industrial applications. Although the element silicon is in the same group as carbon in the Periodic Table, the properties of their simple chemical compounds are sgnificantly different, as one might expect of members of the 1st and 2nd series. This is illustrated in Figure 2 comparing the products of hydrolysis of carbon tetrachloride and silicon tetrachloride. It is significant that, whereas monomeric carbon dioxide gas results from the hydrolysis of carbon tetrachloride, silicon tetrachloride behaves as though it were a tetra-functional reactant resulting in a three-dimensional polymer of unkown molecular weight.

The two most significant properties required for the formation of silicone polymers which can be applied to textile materials are:

1) The ease of hydrolysis of the halides to hydroxyl groups which condense to polymers containing the siloxane bond—Si-O-Si, and
2) The relative ease of oxidation of the silane hydrogen—Si-H—to form cross-linking oxygen bridges.

Figure 3 describes the simplest procedure for preparing a prepolymer



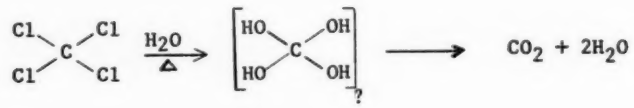
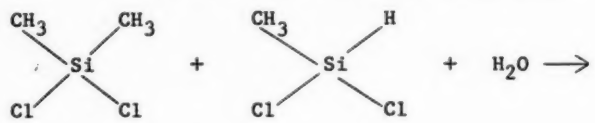


Figure 2
Illustration of silicon compounds to form polymers



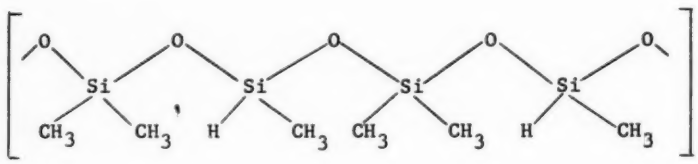


Figure 3
Prepolymer prepared by hydrolyzing of dimethyl dichlorosilane and methyl hydrogen dichlorosilane

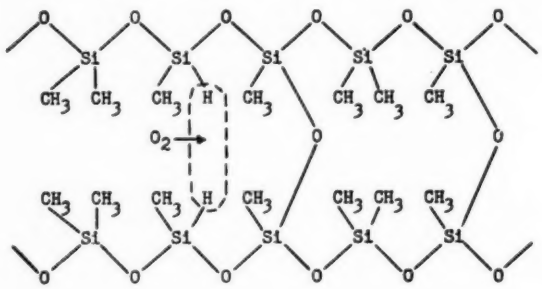


Figure 4
Oxidation of silanic hydrogen to form cross-linking bridges

which is relatively linear and, because of its liquid state, can be emulsified for application to textile materials. This polymer still contains silanic hydrogen which can be cross linked as illustrated in Figure 4. For the treatment of textiles, a relatively low-molecular-weight material available as a fine-particle-size stable emulsion is desirable, so that uniform penetration and distribution throughout the fabric structure and onto the surface of each fiber may result. Since stability in storage is an important requirement for any chemical finish, it is preferable to produce a molecule relatively resistant to oxidation, but which can be catalyzed on the fabric during curing through the use of simple metallic compounds based on zinc, aluminum, or tin.

In keeping with Valko's emphasis on the location of the chemical finish and its relationship to fabric properties, there is sufficient evidence that the silicone resins form a tough, hy-

Figure 5A
Silicone skin after extraction of acetate fabric with acetone

Figure 5B
Silicone sheaths removed from individual acetate fibers after swelling and extraction with acetone/water

drophobic, highly lubricating, flexible film around each individual fiber. This is illustrated in Figures 5A and 5B. In Figure 5A the silicone film residue resulting from the extraction of a commercially finished cellulose acetate fabric with acetone is shown at relatively low magnification. In Figure 5B the split sheath of the silicone film from around a single cellulose acetate fiber is shown at high magnification. It would appear, therefore, that the various properties imparted by silicone finishing to a wide range of dissimilar fibers and fabrics result from the change in surface properties.

Although the structure in Figure 4 is represented as planar or two-dimensional, actually they are relatively long, branched, three-dimensional molecules in which one can expect the hydrophobic methyl groups to be oriented on one side of the molecule and the siloxane structure —Si-O-Si—oriented toward the fiber surface. This hypothesis is perhaps best demonstrated by the water repellency resulting from the high interfacial tension between water droplets and the "methylated" surface. The literature (*16,17,18*) is now rich with examples of the various fabric properties which are affected by the change in fiber surface.

The development of water-repellency properties was the initial objective of silicone finishing. Since this finish did not require reaction with the fiber surface, it is not surprising that a wide variety of fiber compositions, as well as fabric constructions, can be treated with the silicones. This is illustrated in Table V.

In connection with the water-repellency properties of the silicone finish, one can expect to obtain increased resistance to aqueous-borne stains. Figure 6 illustrates this phenomenon on an acetate sharkskin finished with a one percent silicone. It must, however, be mentioned that oily staining is increased on silicone-finished fabrics. This is not surprising, since the wettability of the silicone film by mineral and edible oils is greatly increased. The oil-soiling properties of silicone-finished fabrics are a serious shortcoming which must be overcome, particularly in shirting and necktie applications.

TABLE V
Water repellency of silicone-treated fabrics

Fiber composition	*Per cent silicone*	*Initial spray rating (AATCC #22-52)*	*After three #2 AATCC washes (#36-45)*	*After three perchlorethylene dry cleanings*
100% acetate (taffeta)	.75	100	90-100	90-100
100% acetate (dress suiting)	1.00	100	90-100	90-100
100% Dacron (suiting)	1.00	100	90-100	90-100
100% nylon (ninon)	1.00	100	90-100	90-100
100% rayon (shirting)	1.5 *	100	70- 90	90-100
100% cotton (shirting)	1.5 *	100	70- 90	90-100
50/50 acetate/rayon (shirting)	1.5 *	100	90-100	90-100
50/50 acetate/Dacron (suiting)	1.0	100	90-100	90-100
50/50 acetate/wool (suiting)	1.0	100	90-100	90-100
45/40/15 acetate/rayon/nylon	1.00*	100	90-100	90-100

* Silicone in combination with formaldehyde cross-linking resins for improvement of dimensional stability with wrinkle performance.

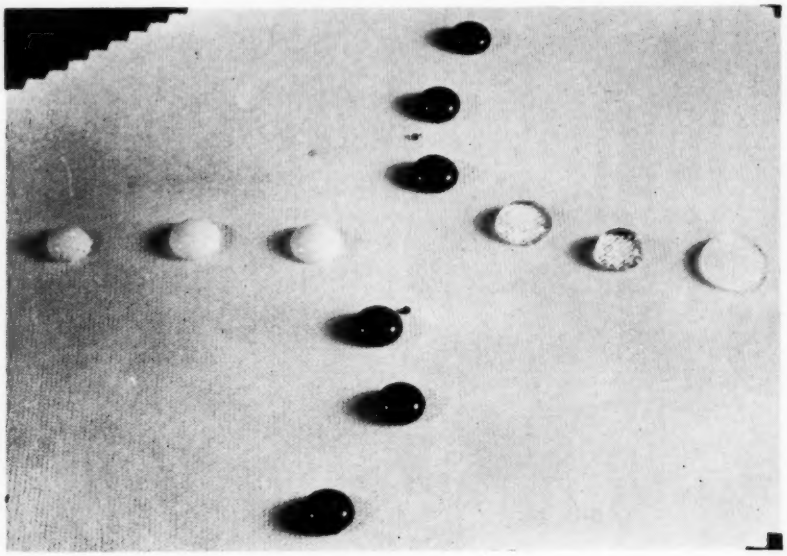


Figure 6
Resistance to aqueous-borne soil

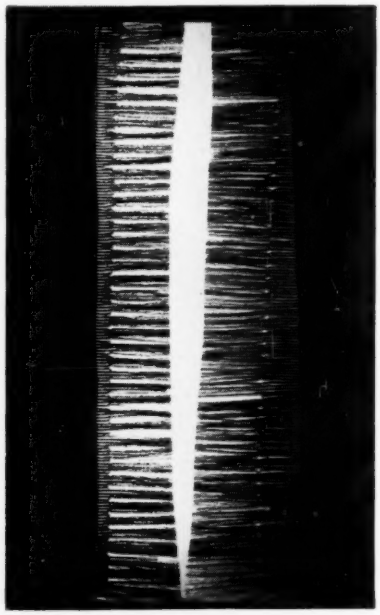


Figure 7
Left side: Excessive needle cutting of yarns due to poor lubricity
Right side: Improvement due to 0.1% application of silicone

The formation of a tough, flexible film of excellent surface lubricity around each fiber can be related to the observed improvement in such properties as abrasion resistance, tear strength, reduction in needle cutting and fusion on sewing, and improved recovery from wrinkling.

The improvement in flex-abrasion properties is illustrated in Table VI, the improvement in tear strength is recorded in Table VII, and the improvement in Monsanto crease-recovery angle is covered in Table VIII. We believe that the improvements in the properties noted are due to the decreased interfiber friction, which permits the attrition forces of abrasion and tearing to be more effectively distributed by the increased freedom of movement of the fiber bundles in the fabric. The improvement in recovery from wrinkling can be related to the lower resistance in the fabric construction to the restoring forces within the fiber and yarn bundles.

The sewability properties of a fabric are too often neglected, resulting in weak seams when needle cutting occurs or unsightly seams when needle-hole fusion occurs, particularly with the thermoplastic fibers. Figure 7 illustrates the effect of 0.1% silicone finish on the reduction in needle cutting on an acetate taffeta fabric. Table IX records the reduction in both needle-hole fusion and needle cutting as a function of percent silicone applied.

One cannot indiscriminately apply a finish without careful consideration of a family of fabric aesthetic and performance properties. Although we have demonstrated the versatility of the silicone-type finish, at least three significant shortcomings result from its use. We have mentioned increased tendency to soil with oily materials. The development of increased static and decreased static dissipation has been observed, particularly on the hydrophobic fibers which are already too prone to produce static attraction of soil and garment clinging in service. In addition, many light-weight and open constructions of fabric will manifest seam slippage and yarn shifting in the body of the fabric, if excessive lubrication is applied.

TABLE VI
Wet and dry abrasion of light-weight acetate fabric

	Stoll flex-abrasion cycles (#1 bar—four-lb load)			
	Dry		*Wet*	
% Silicone applied	*Warp*	*Filling*	*Warp*	*Filling*
Scoured and dyed — 0%	66	65	76	55
Cured blank — 0%	73	64	72	61
Silicone — .25%	230	293	113	94
Silicone — .5%	262	289	124	102
Silicone — 1.0%	253	258	138	104

TABLE VII
Tear strength of silicone-treated fabrics

		Tongue-tear strength/lbs*			
		Dry		*Wet*	
Fabric composition	*% Silicone*	*Warp*	*Filling*	*Warp*	*Filling*
100% acetate dress suiting	0.0	4.5	2.2	3.1	2.2
	0.5	9.1	8.5	5.4	3.1
	1.0	9.9	8.6	4.8	3.0
65/35 acetate/cotton shirting	0.0	6.1	5.9	6.4	5.6
	0.5	7.0	6.5	6.6	5.4
	1.0	6.7	6.0	6.6	5.7
65/35 acetate/nylon	0.0	6.5	5.2	6.1	4.7
	0.5	11.9	9.7	9.9	8.6
	1.0	13.7	11.9	10.8	9.3
80/20 acetate/wool	0.0	3.4	3.2	2.4	2.4
	0.5	7.0	6.2	4.0	3.8
	1.0	7.5	7.0	4.7	3.9
65/35 acetate/Dacron suiting	0.0	7.2	6.6	7.0	6.7
	0.5	13.9	13.5	14.0	13.8
	1.0	14.5	14.2	14.7	14.5

* Tongue-tear Method ASTM 39-49

ALKALINE TREATMENT OF HYDROPHOBIC FIBERS

The use of alkali in the modification of cotton fabric properties has been a standard procedure for almost a hundred years. Although the objectives of mercerization include increased absorptivity of dyes and chemicals, improved luster, increased elongation, and the removal of foreign materials, the change in the mechanical and shrinkage properties can be looked upon as a finishing treatment. During the early stages of the introduction of secondary cellulose acetate (54.5% combined acetic acid), many yards of acetate fabrics were given alkali treatment to partly or completely regenerate the cellulose structure. This was done to make possible dyeability with available cotton and rayon direct, vat, etc, dyes, since only a limited knowledge and a limited range of disperse dyes were available. In addition, the saponification of the acetate fabrics resulted in the elimination of glazing and sticking during ironing.

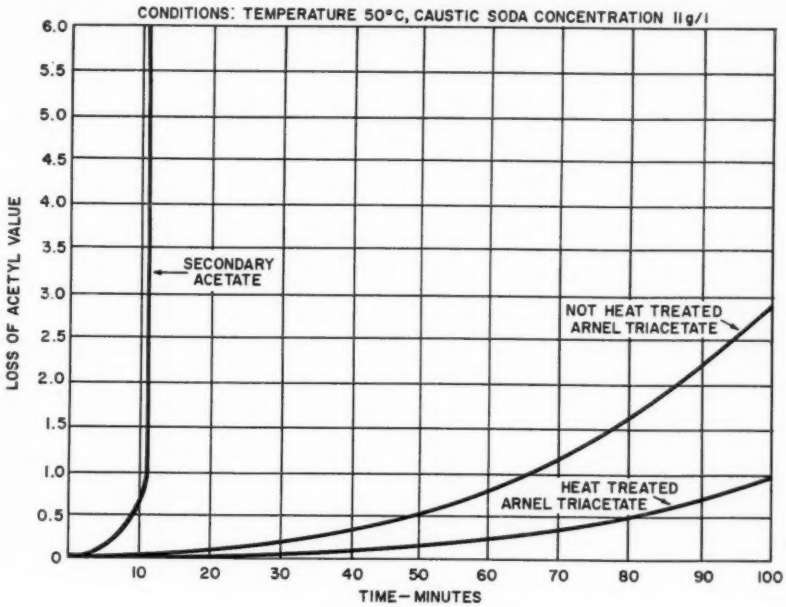


Figure 8
Comparative saponification rates of nonheat-treated and heat-treated Arnel triacetate vs secondary acetate

Recently, a number of patents (*19*) have been granted both in Europe and the USA for the treatment with alkali of polyester fibers based on the condensation product of ethylene glycol and terephthalic acid. In general, the process consists of the treatment of the polyester fabrics with aqueous solution of sodium or potassium hydroxide of from four to twenty percent concentration. When acetate fabrics are treated with alkali, deacetylation occurs with a resultant regeneration of cellulose. However, when the polyethylene glycol terephthalate fiber is treated with alkali, a total removal of surface layers occurs.

The improvements in properties observed by the alkaline treatment of a Dacron fabric are: significant improvement in softness of hand, drapability, and subdued luster. In addition, this treatment has been recommended as a means of reducing the tendency to pilling. The explanation of these improvements is related to the removal of the excessively oriented, high-modulus skin which is introduced during the drawing operation in the manufacture of the polyester fiber. Two to four percent reduction in weight is sufficient to impart properties noted above.

A study of the chemical and physical properties of Arnel triacetate reported by Lacy and Ward (*20*) revealed that, unlike secondary acetate, it is possible to control both the rate and the degree of saponification, and thus form a thin, durable layer of regenerated cellulose around each fiber in the fabric. The relative rates of saponification of the two acetates are shown in Figure 8. This alkaline treatment can be applied as part of the standard scouring procedure using three to four percent sodium hydroxide on the weight of the fabric in the presence of a small quantity of nonionic wetting agent.

Figure 9 is a microscopic cross section of fibers which have been surface saponified to a loss of 3.5% in combined acetic acid. The skin is made visible by dyeing it with direct dyes and surrounding the fibers on the microscopic state with a liquid medium of refractive index equal to cellulose triacetate, but different from that of the regenerated cellulose.

Originally the objective of creating a regenerated cellulose skin on the Arnel triacetate fibers was to reduce static generation and increase static dissipation. This could be expected from the higher moisture absorbency of the skin, thereby increasing the surface conductivity. It is apparent

TABLE VIII
Effect of percent silicone upon the Monsanto crease-recovery angle of 100% acetate suiting

	Crease-recovery angle			
	Warp after		Filling after	
Treatment	*5 min*	*24 hrs*	*5 min*	*24 hrs*
Original untreated	101°	133°	92°	127°
Original water-cured	101	127	94	125
.12% Silicone	116	147	116	153
.25% Silicone	114	146	114	152
.50% Silicone	130	155	129	156

TABLE IX
Effect of percent silicone on needle-hole fusion and yarn cutting during high-speed sewing* on acetate fabrics

	Needle holes fused			
	Number per three inches on acetate suiting		Cut yarns per three inches on acetate taffeta	
Treatment				
Original untreated	48	(100% defect)	80	(90% defect)
Original water-cured	48		85	
.06% Silicone	17		35	
.12% Silicone	0		5	
.25% Silicone	0		3	

* Singer Sewing Machine #241-11

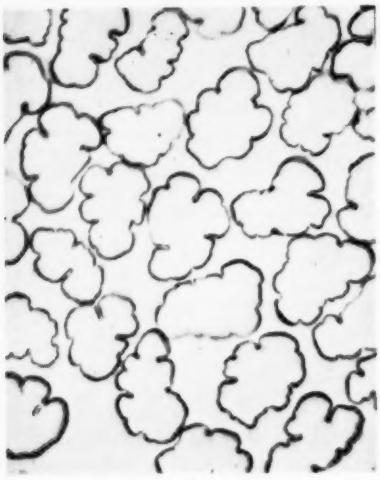


Figure 9
Surface saponified Arnel
3.5% loss in acetyl value

from the resistivity data recorded in Table X that a thousand-fold reduction in resistivity results from this treatment.

Examination of a wide variety of other properties on both tricot knit and flat woven fabrics produced by this alkaline treatment, referred to as the "S" Process, revealed a number of additional improvements. This is not unexpected, since we now have a hydrophilic skin surrounding a hydrophobic triacetate core. We list below the advantages of particular interest to the dyer and finisher, to the cutter, and to the ultimate consumer.

The following are of particular interest to the dyer and finisher:

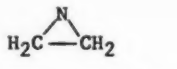
1) Dyeings on "S"-Processed fabric have much better resistance to gas and O-fading. This enables the dyer to eliminate use of codyeing inhibitors, particularly with gas-fast blues, and eliminates the danger of change in shade due to yellowing of the inhibitor as a result of exposure to atmospheric gases.
2) Dyeings on "S"-Processed fabric have improved crocking fastness.

TABLE X

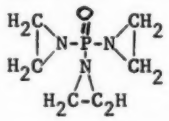
% Acetyl value loss	Electrical resistivity* log ohms/square 50% RH—70° F
0.0	15.3
0.2	13.7
0.4	13.1
1.6	11.8
2.0	11.8
2.9	12.0
5.3	12.1

* AATCC Method T 76–1954.

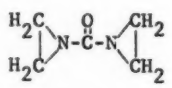
Imine Group



Ethylene Imine



Tris-Aziridinyl Phosphine Oxide



Carbonyl Bis Aziridine

Figure 10A
New chemicals for finishing application
(React with active hydrogen —COOH, —OH, —$CONH_2$, —NH_2, =NH)

3) The "S"-treated fabric has a softer hand than regularly treated fabric. This is of particular advantage in crepes and knit goods.
4) If it is desired to get a crisp hand on the fabric, this thin skin of cellulose allows the application of a thermosetting resin.
5) The "S" Process is an effective soil-cleaning bath, and, therefore, a much cleaner fabric results, particularly in preparation for white and pastel shades.
6) The improvement in ironing normally obtained by heat setting is already obtained by the "S" treatment. This may permit the elimination of heat setting in some styles, especially for drycleanable end uses.
7) The treatment eliminates the need for after-scour on deep shades.

The following improvements should be of particular interest to the cutter:

1) Reduced static attraction. Less clinging and soiling.
2) This treatment will give better handling on the cutting table and reduce sticking to the cutting knife.
3) It will eliminate needle-hole fusion during sewing.
4) It will be easier to spot clean.
5) There will be less glazing on the seams.

The following improvements should be of particular interest to the ultimate consumer:

1) Reduction in static clinging and static attraction of soil.
2) Oily spots are somewhat more easily removed than from regular fabric.
3) The "S"-Processed fabric is slightly easier to iron in that the iron sticks less. The fabric will be easier to iron because of the nonmelting skin.
4) The "S"-treated fabrics have slightly higher tear strength.
5) "S" Processing tends to increase flex abrasion resistance.
6) The "S"-Processed fabric will have excellent dimensional stability in washing.
7) It will be easier to clean.

It should be noted that, in the case of the alkaline treatment of the polyester fiber, the improved properties are achieved by the removal of a skin which contributed undesirable properties to the fabric; whereas in the case of Arnel triacetate, the alkaline treatment results in the creation of a hydrophilic skin which provides a reactive surface for imparting durable modification of hand.

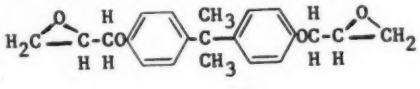
In the light of our experience with surface treatment of Arnel triacetate to generate reactive functional groups, it is conceivable that an alkaline treatment can be developed for polyacrylic fibers to superficially convert the nitrile group (—C≡N) to amide (-C-NH_2) or all the way to carboxyl (—COOH).

NEW CHEMICALS AVAILABLE FOR FINISHING

In the past, many chemical finishes developed for the manmade fiber, viscose rayon, found use on the natural fiber, cotton. This trend is likely to be reversed through the efforts of

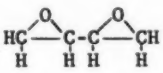
the cotton chemical laboratories of the Southern Utilization Research and Development Division of the Department of Agriculture. In their efforts to chemically modify cotton, they have explored many reactive functional groups without initially considering availability, cost, toxicity, or immediate reduction to practice. Figure 10 presents compounds containing imine, epoxy, and isocyanate groups. A typical example is ethylene imine, which is a notably toxic compound and which cost SURDD one hundred dollars for the first pound sample. Their work disclosed that this cyclic structure could be catalytically opened to react as a monofunctional material with the hydroxyl groups on cellulose. This reaction was used in developing the fire-retardant compound *tris*-aziridinyl-phosphine oxide (APO). Being trifunctional, this compound also appears to produce cross-linking bridges within the cotton fiber, and improved dimensional stability and wrinkle recovery were obtained on the fire-resistant cotton fabrics. We can expect to hear more of this compound and the simpler difunctional carbonyl bis aziridine compound as components in functional finishes for cotton and rayon.

Another reactive structure is the oxide or epoxy group. A typical structure used for the preparation of tough enamels is based on a bisphenol reaction with chlorohydrin.

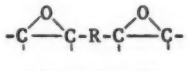


Ethylene oxide ($H_2C—CH_2$), like ethylene imine, is a monofunctional reactant. The simplest dioxide or epoxy compound is butadiene dioxide. The Shell Chemical Company has made most notable progress in developing epoxy compounds for application to cotton fabrics in "wash and wear" finishing for reduced chlorine properties. From the Schroeder, et al, patents (*21*) one can infer that the epoxy monomers developed for textile application are produced as a reaction product of glycerol or other aliphatic polyols with epichlorohydrin. A similar product marketed as Eponite 100 has met with moderate success when applied to cotton fabrics in conjunction with polyvinyl alcohol and epoxy soybean oil and a polyethylene emulsion as lubricant using zinc fluoroborate as a catalyst. Avoidance of chlorine retention and "ease of care" properties are the objectives.

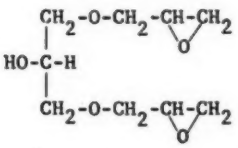
The isocyanate group will readily react with hydroxyl groups on the cellulose molecule. Diisocyanate can be expected to form cross-linking bridges and therefore to change the swelling and the elastic-recovery properties of cotton and rayon fabrics. These materials are relatively toxic, but further exploratory work on such structures as the durene diisocyanates is justified.



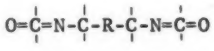
Butadiene Epoxide



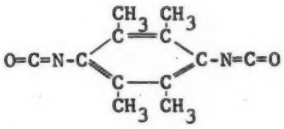
Epoxy Group



Epichlorohydrin Product with Glycerin



Isocyanate Group



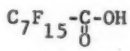
Durene Diisocyanate

Figure 10B
New chemicals for finishing application

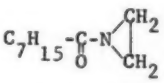
A number of monofunctional reactants, listed in Figure 11, have recently become available. This will add to

Fluorochemicals

Chromium Complex of Perfluorooctanoic Acid

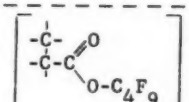


Perfluorooctanoic Acid

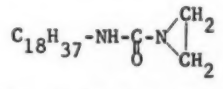


N,N-Ethylene Perfluoro-octano Amide

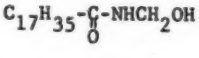
Polyacrylate with Fluorinated Alkyl Ester Group



Stearyl Derivatives with Reactive Group



Octodecyl Ethylene Urea



Methylol Stearamide

Figure 11
Monofunctional reactants for water and oil repellency

the list now represented by methylol stearamide. These include the octadecyl ethylene urea which, in conjunction with standard UF and MF finishing, imparts water repellency, softness of hand, and improved sewability.

The increased interest in soilage resistance now includes consideration of oily soils. A number of fluoro chemicals developed by Minnesota Mining and Manufacturing Company are finding increased application, particularly in the water and oil repellent treatment of woolen fabrics. Both a chromium complex of perfluoro octanoic acid and a polyacrylate prepared with fluorinated alkyl ester sidechains are now available.

SUMMARY

A number of specific chemical-finishing treatments have been discussed with the objective of describing how a wide variety of fabric properties may be modified or improved. For each particular end use a different group of functional and aesthetic properties is required, and the chemical finishing is used to supplement the properties of the selected fibers and fabric construction.

It is now possible to draw a more complete profile of satisfactory performance in which at least one important property is promotable and no serious shortcomings are evident. The "ease of care" finishing of cotton and rayon fabrics can be used to illustrate the effect of the formaldehyde reactants which influence the internal fiber properties in reducing shrinkage in washing, maintaining greater shape retention in wearing, and increasing resistance to and recovery from both wet and dry wrinkling.

The application of the silicone polymeric finishes to the surface of each fiber in the fabric construction can be related to such properties as water repellency, improved tear strength, abrasion resistance, and sewability. Here the properties of the tough hydrophobic lubricating skin affect the surface interaction of each fiber, rather than change the intrinsic fiber properties.

The alkaline treatment of such hydrophobic fibers as Dacron and Arnel triacetate is used to illustrate changes in fiber properties due to the removal of an undesirable skin or resulting from the creation of a hydrophilic skin. In the case of the Arnel triacetate, the regenerated cellulose skin around each fiber results in improved antistatic properties and provides a reactive surface for more versatile finishing.

The imine, epoxy, and isocyanate reactive functional groups were examined as chemical finishes likely to have increased importance in the future, particularly on cotton and rayon. Although the specific compounds examined are relatively expensive and difficult to handle at the present time, the wide-spread acceptance of silicone finishing in a relatively short time justifies active consideration of these new materials. Increased concern with oily soilage, as well as inorganic soil, has led to the development of fluorinated hydrocarbon compounds which, on wool, impart both water and oil repellency.

The increased emphasis on promotability of textile materials requires a greater degree of versatility in every stage from the conversion of the fiber into the finished garment. This can be most efficiently achieved if the mechanical and chemical properties of the commercially available fibers are better understood. This knowledge must also include the effect of the specific chemical treatments on these fibers in terms of the site of the reaction and the effect on such properties as elastic recovery, swelling, and tensile strength.

ACKNOWLEDGMENT

This paper is a summary of the cooperative efforts of textile chemical manufacturers, commission dyehouses, and the technical activities of the Celanese Corporation of America. Appreciation must be expressed to Reiner G Stoll, director of applications and product development for the Textile Division of the Celanese Corporation of America, for his encouragement and guidance, and to William J Myles and his Finishing Research Group, who have made available the data concerned with Arnel triacetate.

C H Fisher, director of the Southern Utilization Research and Development Division of the Agricultural Research Service of the United States Department of Agriculture, and his staff concerned with the chemical treatment of cotton are responsible for permission to use recent information on cotton-garment finishing and special reactive chemicals.

REFERENCES

(1) "Technology of Synthetic Fibers," Chapter 10, 251-283, Fairchild Publications, New York (1953 Edition).
(2) Barach, J L, Stoll, R G, and Tesi, A F, "Predicting Commercial Acceptance of a Fiber," presented before the Textile Research Institute in New York, NY, on March 14, 1958.
(3) Valko, E I, *Textile Research J* **22**, 213 (1952).
(4) Nuessle, A C, Fineman, M N, and Heiges Jr, E O, *ibid* **25**, 24 (January 1955)
(5) Steele, R, and Giddings, J L, Fourth Cotton Chemical Finishing Conference, 1955.
(6) Cooke, T F, Dusenberg, J H, Kienle, R H, and Lineken, E E, *Textile Research J* **24**, 1015 (December 1954).
(7) Cameron, W G, and Morton, T H, *J Soc Dyers Col* **64**, 329 (1948).
(8) Alvasker, J, and Turner, H A, *ibid* **71**, 797 (December 1955).
(9) Gagliardi, D D, *Am Dyestuff Reptr* **45**, P99 (February 1956).
(10) Smith, A R, *Textile Research J* **26**, 836 (November 1956).
(11) Reid, J D, Mazzeno Jr, L W, Reinhardt, R M, and Markezich, A R, *ibid* **27**, 252 (1957).
(12) Graham, R T, presentation at the Sixth Cotton Chemical Finishing Conference at Washington, DC, on October 2-3, 1957.
(13) Rochow, E G, "An Introduction to the Chemistry of Silicones," John Wiley & Sons, Inc, New York (1946).
(14) McGregor, R R, "Silicones and Their Uses," McGraw-Hill, New York (1954).
(15) Reed, C E, Thirtieth Edgar Marburg Lecture, 1956.
(16) Dennett, F L, and Gibson, C, *Am Dyestuff Reptr* **42**, 275-278 (April 1953).
(17) Fortess, F, *Ind Eng Chem* **42**, 23-24 (November 1954).
(18) Ruile, Hans, *Am Dyestuff Reptr* **25**, 947 (December 1957).
(19) British Patent 786,153.
(20) Lacy, R E, and Ward, G C, *Can Textile J* **75**, 49 (January 24, 1958).
(21) Schroeder, Carl, et al, US Patent 2,774,691 to Shell Chemical Co, Dec 18, 1956; Schroeder, Carl, et al, US Patent 2,794,745 to Shell Chemical Co, June 4, 1957.

AATCC Calendar

COUNCIL
Sept 19 (Charlotte, NC); October 30 (Conrad Hilton Hotel, Chicago, Ill); May 1959 (Montreal, Canada)

NATIONAL CONVENTIONS
Oct 30-Nov 1, 1958 (Hotel Conrad Hilton, Chicago); Oct 8-10, 1959 (Sheraton Park and Shoreham Hotels, Washington, DC); Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa); September 28-30, 1961 (Buffalo, NY); 1962 (Southern Region)

DELAWARE VALLEY SECTION
Sept 12 (Wilmington Meeting), Oct 17, Dec 5

NIAGARA FRONTIER SECTION
Sept 26 (Niagara Falls, Ont); Oct 24 (joint meeting with CATCC at St Catherines, Ont); Dec 5 (Buffalo, NY); Feb 20 (Niagara Falls, Ont); April 4 (Hamilton, Ont—joint meeting with CATCC)

NORTHERN NEW ENGLAND SECTION
Sept 12 (Outing—Wachusett Country Club, West Boylston, Mass); Oct 17 (QM Research & Development Ctr, Natick, Mass); Dec 5 (Hotel Vendome, Boston, Mass); Jan 16 (Colonial Club, Lynnfield, Mass)

PIEDMONT SECTION
Sept 19-20 (Hotel Charlotte, Charlotte, NC)

RHODE ISLAND SECTION
Sept 26 (Management Night — Warwick Country Club); Oct 23 (Providence Engineering Society); Dec 4 (Annual Meeting—Johnson's Hummocks Grille, Providence)

SOUTH CENTRAL SECTION
Sept 13 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION
Sept 13 (Ida Cason Callaway Gardens, Chipley, Ga); Dec 6 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION
Sept 26 (Hartford, Conn); Oct 24 (Annual Meeting—Rapp's Restaurant, Shelton, Conn; Dec 5 (Rapp's Restaurant, Shelton, Conn)

Wash-Wear Resins———

(*Concluded from page* P512)

controlled, however, by careful after-washing of the fabrics in an alkaline detergent to free the amines and allow them to volatilize during the drying operation.

DAMAGE DURING COMMERCIAL LAUNDERING———The best evaluation of a resin treatment to commercial laundering is obtained by making shirts and subjecting them to standard launderings, as given in Table III. Examination of appearance, crease resistance, soiling and damage is thus possible after one, five, 10, 20, 30 and 50 consecutive washings. Figure 2 indicates the degree of resistance of various resins under laundering conditions that are average.

The procedure used to assemble these data is rather time-consuming, expensive, and does not readily lend itself to textile laboratory control. An alternate means of evaluating the potential resistance of a resin to commercial laundering is to give five full Sanforized washes (*9*) at the boil and then evaluate the chlorine resistance by AATCC 69-52. The damage should show below 10%. A check on the crease recovery will indicate whether the resin is still present.

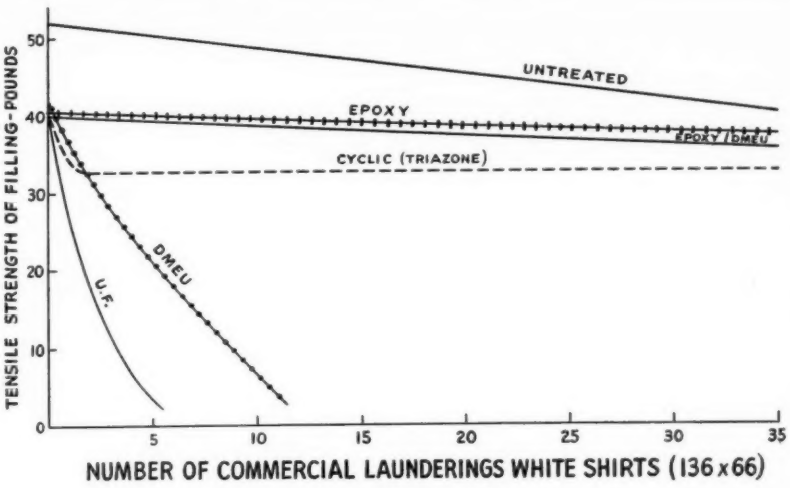


Figure 2

CONCLUSION

Wash-wear is defined in terms of durability to washing, thus differentiating it from standard crease recovery. Test methods to evaluate chlorine resistance are discussed and a practical household chlorination test is used as a means of clarifying the confusion created by AATCC 69-52 (chlorine damage).

The relationship between the crease recovery of a fabric and its wash-wear rating shows the difficulty of predicting behavior by standard crease angles of a fabric. The severity of commercial laundering is shown and indicates that wash-wear effects of the highest rating cannot withstand repeated commercial laundering.

Resins used on white shirts should have high chlorine resistance; otherwise, the fabric will damage rapidly. Wash-wear shirts often are sent to commercial laundries and to be considered satisfactory should not show fiber damage beyond 10%.

REFERENCES

(*1*) Trade mark registered by Procter & Gamble Co.
(*2*) Trade mark registered by Procter & Gamble Co.
(*3*) Trade mark registered by Colgate-Palmolive Co.
(*4*) Lawrence, E W, and Phillips, R H, "'Wash and Wear' Fabrics", *Am Dyestuff Reptr* **45**, P548 (August 13, 1956).
(*5*) Irvine, J B, and Kress, B H, "Acetal Cellulose Reactants", *Textile Research* **28**, 148 (February 1958) wherein the following US Patents are mentioned: 2,785,947; 2,785,948; 2,785,949; 2,785,996; and 2,786,081 (assigned to Quaker Chemical Products Corp).
(*6*) US Patent 2,752,269 (assigned to Shell Development Co).
(*7*) US Patent 2,794,754 (assigned to Shell Development Co).
(*8*) Gagliardi Research Corporation.
(*9*) Trade mark registered by Cluett, Peabody & Co, Inc.

Membership Applications

SENIOR

Robert W Eltonhead—Asst director, Organic Chem Dept, Central Research Labs, Interchemical Corp, New York, NY. Sponsors: R A Duchacek, R A Pizarello. (Met).

Lee R Schiltz—Research chemist, Swift & Co, U S Yards, Chicago, Ill. Sponsors: R W Yocom, W B Broadbent. (MW).

Paul W Stewart—Overseer of printing, Wm Carter Co, Barnesville, Ga. Sponsors: J C Cook, R A Stowe. (SE).

George F Wagner Jr—General mgr, Ware Woolen & Hampshire Woolen Co, Ware, Mass. Sponsors: G O Linberg, G P Paine. (NNE).

ASSOCIATE

Maurice A Lynch Jr—Asst mgr, special products, textiles, Silicones Div, Union Carbide Corp. New York, NY. (Met).

STUDENT

Edward L Eubanks and **Douglas B Stallworth**—Students, Alabama Polytechnic Institute, Auburn, Ala. Sponsor: J H Cox. (API).

Elected to Membership

July 2, 1958

SENIOR

William A Ames	Henry Papini Jr
Emil Grunteld	Homer A Poovey
William F Huckaby	John H Read
M I Khan Jr	George Tiffany
Irving Kleinman	John A Welbourn
Charles K Merkel	Thomas Westarp
S A Mullen Jr	Yuan Loong Yang

ASSOCIATE

Mrs E Earl Andrews	M Langenbahm
Jacques M Blanc	Louise M Norton
Emilio Haim	Sister Mary Pierre

STUDENT

Sybil A Brittain	Betty Faye Smith

Employment Register

58-14

Education: Graduate, Philadelphia Textile Institute.

Experience: 25 years in all phases of woolen operation; experienced in color matching and color development on stock and piece goods, microscopy, water treatment relating to sewage and waste disposal operations, bleachings, quality control methods including materials, dyestuffs and chemicals. Familiar with all types of treatment concerning wool and hair fiber. Administrative ability.

Location desired: Northern area preferred.

Position desired: Plant chemist or technical superintendent.

6-28, 7-11

ACTIVITIES OF THE LOCAL SECTIONS

Piedmont

THE regular Spring Meeting of the Piedmont Section was held April 26, 1958, at the Hotel Washington Duke in Durham, NC.

The Research Commitee meeting, presided over by the Chairman Fred Fortess, was held in the morning and was attended by more than a hundred members, showing considerable interest. Reports of projects were made by project leaders and this was followed by a talk by Sidney Cone, Cone Mills Corp, the text of which follows.

The Officers' Luncheon was held at noon, with Southern Region vice-president H Gillespie Smith present. He made a short talk on the aims of the association.

The Technical Session in the afternoon included papers by George C Ward of Celanese Corp of America, "Cotton Dyehouse Processing of Arnel/Cotton Blends," and Fred M Rawicz, a graduate student at N C State College, "Some Aspects of the Mechanism of Carrier Dyeing of Dacron Polyester Fiber."

A social hour was held and followed by the banquet, at which William H Ruffin, president of Erwin Mills, spoke on some of the problems confronting the textile industry.

There was a total registration of 266 at the meeting and 208 attended the banquet.

AATCC PRESIDENT RECEIVES SCROLL — George O Linberg, left, AATCC president and vice president of Synthron, Inc, Ashton, RI, has been presented a scroll, citation and honorary membership in the Lowell Technological Institute Alumni Association for outstanding service to industry and education. Clifford A Harvey of Vertipile, Inc, alumni president, is shown making the presentation at the recent annual reunion of LTI alumni. **(See page 500 of July 14 issue).**

An Address by Sydney M Cone Jr*

WHEN men as important to our industry as Luther Arnold and Fred Fortess come to me with a request to "Speak Out!", I owe them a major effort to Speak Out and to make it clear.

It has become more obvious in the textile industry that our technical men and women are holding our heads above water these days. Nobody is being rude to them any longer. On the contrary, we are building them the shiniest new palaces in which to practice their mysterious arts. Our technicians are delighted with the change in their position, but confused by the new emphasis on their importance. What miracles do we expect them to produce to justify this pleasant new aura of deference?

I was obliged to redraft this talk, as a consequence of the surprising, and gratifying, response to this meeting. There are gentlemen of much experience in this gathering. I am delighted. I have been a member of the AATCC and shared in its problems and known the men who belong to it, since H A Barnes took me to Burlington, NC, as his guest in 1925, not quite 33 years ago. The technical problems then were more difficult than now. I recall that the bleachery bugaboo was oxycellulose. The dyer's equipment was balanced by guess and by touch. The hydro in the dyebath was kept at a level of concentration measured by the word "plenty." The allowance for contraction of cloth in a wet bath was managed by a roughly calculated tapering of the guide rolls, and it was not unusual for a heavier fabric to jerk a roll or two right out of its settings: "light" goods finishers were in separate plants from "heavy" goods finishers for this reason. Our own progress in solving these technical problems was so rapid that we made a rule against running to the Patent Office with our discoveries for fear of disclosures we would be powerless to police. A heavy secrecy surrounded certain departments. One of our central laboratory's improved chemical mixtures, used to crinkle the print cloths for the fabric known as "plissé", became a real cloak-and-dagger operation. Well, I think these private discoveries are pretty much in the past as the larger distributors of machinery, controls, and chemicals rush their new products by way of expert salesmen to the college-trained purchasing men, whose beautiful assistants sit at the front doors with welcoming smiles. . . .

Yes, those were the tough days. Now we have everything. We have so much of everything that we, as a company, need one research division for sorting out the chemicals as fast as they come in: 239 new dyestuffs in 1957, 328 new chemicals, and so on. We need a second research division for trying out the new machinery. These tests are made in more than one mill. If any of my listeners is equipped with only one mill, well, he just has to pick and choose more cleverly from the large numbers of new devices. One of our mills might be testing "big cans", another mill might be testing "big packages", and a third "big shuttles"; and then we need a runner to go around from mill to mill and liaison these jobs; and then a writer to evaluate and report and a printer to put out all the reports, and then, of course, the *readers*, who are the executives. We might have a Research Division for Quality Control, though I prefer to think that most of this kind of work would be decentralized. Decentralized quality control means to me, for example, that the dyer checks his own dyes and dyeing on the spot. Currently, we might have a research division that is manufacturing some things on its own, which would put management to a constant choice between "make or buy." We certainly would have a business manager to run costs on these matters, and control them. And we might even do a job for our customers, relating fabrics to end uses. This is how a company would look at its research organization.

But you are thinking now as members of AATCC, rather than as employees of your companies. From the Association point of view, how does our organized research shape up?

How would we orient the research of your Section to your own capac-

* Mr Cone, vice president of Cone Mills Corp, Greensboro, NC, delivered this address before the Piedmont Section's Research Committee on April 26, 1958.

ities and to needs of the industry in general?

First, let us realize that the Piedmont Section is a very substantial concentration of practical bleachers, printers, dyers and finishers. It might very well be the biggest concentration of such talent in the whole world. Certainly, we have every kind of practical finishing represented in our Piedmont Section, and richly represented. This means that we have the people who know the particular problems of applying bleach, print, dye and finishing chemicals and dyestuffs. These are the men who have to control shade and meet performance standards.

Second, located in Piedmont Section territory are the distributing offices of the dye and chemical manufacturers. These offices are staffed with technicians who speak the language of the man in the plant, and who, likewise, speak the language of the salesman. These sales technicians constitute another large section of our membership.

Third, we have the salesmen who have the problem of distributing the supplies, of moving them from the dyeworks or chemical factory, advising on the inventory controls, and having it available for the dyehouse as needed.

This is the makeup of the Piedmont Section. For what kinds of research would these three groups of men—salesmen, technicians, practitioners—be best fitted? The answer seems pretty obvious when the question is put this way; these people are best fitted to study the problems of practical application.

Your dyestuff factories are investigating and researching new products, but they cannot put these products to the real test without your help. They can carry them just so far through laboratory testing, then they have got to get into continuous operation at a higher speed under plant conditions to see if they really are going to perform properly. In the Piedmont Section these performance tests are going on all day, every work day. It is at meetings such as this that the salesmen, technicians and practitioners can meet and develop the teamwork that can solve the problems of application. There are problems of application that have defied us—that have not been solved. It is the mission of these meetings to discover the unsolved problems and to select from the unsolved problems the special unsolved problem that will be the target for an annual contest paper.

In discussing this matter with Fred and Luther, I brought up the general subject of test methods. AATCC's national organization has contributed valuable testing methods for use in our plants and laboratories. It is true, though, that test methods, while used at the local level, are not primarily research projects for the local level. Your people are aware of the inadequacy of test methods for chlorine-retention measurement and many other specific items. It is natural for chemical and processing developments to precede test-method developments. However, Fred and Luther pointed out that the development of test methods belongs at the national level rather than at the local level, and with this I agree. Your membership on national committees puts you in position to keep the national committees aware of the shortages and shortcomings of the test methods. Your active participation in the test-method research will take place on a national level by your membership on national committees.

There has been some question about your participation in the development of new dyes, chemicals and assistants. This is another area that had best be left to specialization. Nobody wants to disclose his new dyes or chemicals or assistants until their products have had the protection of patents or such other protection as may be devised to recover the cost of this kind of research to the company that has put up the money for it. Consequently, your research in this area is either at a later stage or of a highly confidential nature.

Occasionally, our young men are engaging in studies of a highly confidential nature, and when this is going on in one of our plants, the executive in charge of the plan gets very uneasy about having them participate in meetings of this kind. There are some executives who believe that they have enough "patent medicines" in their shops to justify cutting off the contact of their technical people from all other technical people. To these executives, I would like to suggest that it is impractical to preserve secret processes or secret methods by keeping their technicians out of circulation. If the Association did not exist and our present means of communicating with each other were cancelled out and eliminated, I do not believe that the natural gregariousness of our people would be changed over night. On the contrary, I believe our technicians would inevitably gravitate unto like, and that they would continue to exchange general information of a proper unclassified nature. On the positive side, these meetings and information exchanges are most educational to our younger technicians in particular, and our older ones too, with the very beneficial by-product of eliminating expensive and unsatisfactory and stupid procedures and the substitution of procedures that will give more satisfactory products to our customers. No one distributor is going to monopolize a market for very long. Neither will one satisfactory product necessarily offset the losses from a series of unsatisfactory products and their destructive effect on the customer. I can cite examples of the destructive effect on customers of putting out unsatisfactory products and having customers pass the word among themselves to avoid such and such an item because of its . . . well, chlorine-retention quality or some other quality that has been brought up to represent the ultimate in dissatisfaction in a cusomer's line.

I do not share the general optimism that our personnel is moving forward from lesser knowledge to greater knowledge, or that our dyehouses are being operated from the collected world experience. On the contrary, our dyehouses are being operated by individuals whose knowledge depends on their own training and capacity, and each individual starts more or less from scratch. What he learns in his own dyehouse consists of a hodgepodge of facts and prejudice. What he learns in these Piedmont Section meetings is going to increase his knowledge of facts, expose the prejudices, and expand his general capacity. I would rather have our young men go out to these meetings three or four times a year than to see them ingrown within our own establishments, even though I believe that our own dyehouses are as good as the best in the industry. We encourage our technicians to attend these meetings by paying their membership dues, transportation, and direct costs for making the trips.

I have spoken, now, of several things. Let me recapitulate. First is the new importance of our technicians. Second is the plethora of improved methods and materials now available. Third is the wide distribution of the new methods making them readily available. Fourth is a suggested table of organization to enable a company to cope with the flood of new things. Fifth is advice that AATCC concentrate on the problems of the practical relationship of machines and chemistry to fabrics. Sixth is a sideglance at the varying policies in our business governing seclusion and secrecy versus association and disclosure.

PRELIMINARY NOTICE

Thirty-Seventh National Convention

Auspices of the Western Region

Conrad Hilton Hotel, Chicago, Ill

October 30, 31, November 1, 1958

Big Ten Football Game to Highlight Convention Entertainment

Arrangements have been made by the Entertainment Committee for the Chicago Convention to obtain up to 100 tickets for the home coming game of Northwestern University's football team against Ohio State University in Evanston, Ill on Saturday, November 1st. Reservations should be sent to the chairman of the Entertainment Committee:

J Gordon Stott
Ciba Company, Inc
7535 Lincoln Avenue
Skokie, Illinois

RESERVATIONS MUST BE MADE BY AUGUST 15TH!!!

THE Western Region invites you to attend the 1958 National Convention to be held on October 30, 31, and November 1, 1958, at the Conrad Hilton Hotel in Chicago, Illinois.

For your convenience all activities relating to the Convention will take place in the one hotel and adequate accommodations will be available for your comfort.

PROGRAM

Thursday, October 30—Registration 9 AM-5 PM

Morning: Council Meeting and Committee Meetings

Luncheon: Olney Medal Award

Afternoon: Technical Sessions

Evening: No Formal Program

Friday, October 31—Registration 9 AM-5 PM

Morning: Technical Sessions

Afternoon: Intersectional Contest Papers

Evening: Annual Banquet

Saturday, November 1—Registration 8:30 AM-10:30 AM

Morning: Symposium—AATCC Research

EXHIBITS

There will be an outstanding exhibit—noncommercial in character—reflecting the current status and advancements made by our own AATCC Research activities.

It is the express wish of the Committee that, since the exhibits are noncommercial in character, all supplying firms supporting the organization and others please refrain from setting up commercial exhibits anywhere within the hotel during the course of the Convention.

PERSONNEL SERVICE

For the purpose of introducing members to employers, Personnel Service will operate, without charge, from Thursday afternoon, October 30th, through Saturday morning, November 1st. Members expecting to use this service are requested to write in advance to AATCC National Headquarters, Box 28, Lowell, Massachusetts.

HOTEL RESERVATIONS

Adequate hotel reservations for the Convention will be available at the Conrad Hilton. Reservations may be made direct to the Conrad Hilton Hotel noting you will attend the AATCC Convention, or may be made through the Hotel Committee, on applications that will be mailed with the final Convention notice in September. Upon receipt of your final notice please fill out the hotel reservation and/or Convention registration forms promptly and return as requested.

LADIES' PROGRAM

A special program has been arranged for the entertainment of the ladies attending the Convention. For their convenience, a Ladies' Hospitality Room will be open throughout the Convention. Details of the program will be announced later and will include the following:

Thursday afternoon—Reception

Friday morning—Program at American Broadcasting Company Studios.

Friday afternoon—Luncheon and Style Show

Saturday afternoon—For those wishing to remain in Chicago Saturday afternoon, arrangements have been made to provide a block of tickets (at extra cost) for the new Cinerama show.

The regular Technical Sessions will be open to all ladies wishing to attend.

ENTERTAINMENT

While no formal entertainment has been scheduled for the Convention, arrangements will be made on your request for tickets for the theater and athletic events for Thursday evening or Saturday afternoon and evening. Your requests should be made to the Entertainment Committee as far ahead as possible, as no guarantees can be obtained.

TRANSPORTATION

The Transportation Committee feels that, because of the central location of Chicago, members and their guests will have no difficulty in obtaining the service of their choice. Local transportation will be furnished for the Ladies' Program.

FINAL NOTICE

About the end of September you will receive the Final Notice concerning the complete details of registration, hotel reservations, dinner and luncheon tickets, ladies' program, and the Technical Program.

JULY DITTY
1958

Inter Alia—Inter Nos

P J WOOD

COMMITTEE

Some committees in some societies appear to arrive nowhere in a perfect frenzy, resulting in frustration of the committee members who care, and futility for the organization.

"Anon", that most prolific writer of all time, once defined a committee as a group of men who keep minutes and waste hours. And, indeed, this may be a pretty accurate description of certain committees that we might mention by name—but won't.

But there is one committee to which we would award the palm of merit for almost perfect attendance, practically perfect attention and a speed of execution that was simply marvelous—no golf game reminiscences—no dawdling—strictly business.

This is the Committee on Analytical Methods of AATCC, which has been functioning on the subjects assigned to it with neatness and despatch. Credit is due to every member of the Committee, and if we had to single out any one member for special praise it would be Emil G Wiest, who has acted as secretary during the three-year term. We feel confident in saying that it was a source of pleasure to every member of the committee to receive the announcement that the result of the recent election of a new chairman for the committee, for statutory reasons, showed a unanimous decision in favor of Dr Wiest.

UNMENTIONABLES

When we were very young, it was with bated breath that any mention of underwear, and particularly those garments in use by the feminine population, was made. It was considered indelicate to use the word "chemise" in polite society; it was good form to have no knowledge of such things.

But lo, in these decadent days, no one seems to give a tinker's ballyhoo whether anyone talks right out loud about these matters or not witness the present vogue of the "chemise dress", which would have been nothing short of a public scandal in those Victorian days of which we speak and to which we now hark back. Vulgar boys used to call them "shimmies", remember?

And now, horror of horrors, along comes the chemise for men; according to the illustrations it appears to be a sport shirt with a baggy back, which might be all right for the boys who bend double over their plates to "wolf" their food, but there is no telling how they will go. Naturally, we are for anything that will improve the textile business and maybe this is it.

For most men, a bag on the front, would be both more convenient and more appropriate.

SALAAM

"God gave us tongues that we might say pleasant things to our fellow man". So said Heinrich Heine. From our reading of this celebrated poet's effusions, in the days of our youth, we gathered that he was especially adept at saying pleasant things to his fellow woman, unless, in this quotation we can assume that "man" embraces woman, as someone once said.

Like Heine, we love to bestow a word of approval where it is merited, unless the cruel blue pencil of our senior editor, who is our junior, intervenes to stem the tide of our vehemence, or lack of space prevents.

Such a necessary curtailment occurred a few weeks ago when we were talking about some of our friends at Chemstrand.

Among others, of Robert H Brigham Jr, director of public relations, who is responsible for the beautiful Annual Report for 1957, of which he sent us a copy. He has put together a most attractive booklet containing the concise report of Edward A O'Neal Jr, president of the company, two pages of it, and not a superfluous word—a financial report comparing operations of the last two years, and a graphic exposition of where the sales dollar went. All this followed by a few gorgeously illustrated pages in color, showing what is being done with the products of this up-and-coming company. And, mind you, he does all this without the slightest allusion to that common illusion, sex. Bravo, Robert Brigham.

Man-made chemical textile fibers are destined to command increasing interest in the future of mankind.

THREE-DECKER SANDWICH

When the tufted textile manufacturers started making tufted textiles, which is something that has happened within the memory of living men, they started something new.

When they held their convention this year, at a southern seashore resort, they had their own original way of doing it, which, we must say we greatly admire.

For one thing, they called it a parley (no, Elmer, not a parlay, which, we have been told, is something to do with horse-racing). A parley connotes more of a free and easy discussion among friends.

For another thing, they do not rush down from their various manufacturing establishments—bang BANG—right into the business of their parley. No, No. The first day is given up to deep sea fishing—all day—and a beachcomber party in the evening. By the time these two parties are over, Everybody knows everybody. For one day, the cares that infest the day have packed their tents like the Arabs and silently stolen away.

This unique arrangement should ensure that every member is punctually in his place the next morning when the roll is called at 9:45 AM, even those that stayed ashore to play tiddleywinks.

Then again, mark you, they took up the load slowly. The first session lasted only half a day. In the afternoon they had four annual events, the golf tournament, the fishing off the pier tournament, the horse-shoe-pitching tournament and the ladies' putting tournament.

Alternating activities in this manner should take the tedium out of any convention. But the next two days they went at it hammer and tongs, including the annual banquet and finishing with a buffet luncheon on the beach. Bravo TTMA.

NEWS FROM AFAR

South Africa is quite a wool-producing country, so it is not surprising that the South African "Textiles", published in Cape Town, is interested in the habilaments of the American man.

Our worthy contemporary declares that woolen cloths seem to be gaining in popularity among our men as compared with worsteds, these fabrics representing 89 percent of the total output of wool fabrics of all weights, covering men, women and children. This proportion is the same as in 1956.

On the other hand, there seems to be a tendency to make the lighter fabrics for men (weighing less than nine ounces per yard) of woolen yarn. In 1957, woolens accounted for 54 percent of production in this weight range, as against only 24 percent in the previous year.

This being thus, it would be interesting to have information from two points of view. First, motivation research to discover what controls this preference; second, a spot of practical research to determine the relative porosity of the two types of fabrics, for this would seem to be a ruling factor in the comparative comfort of wearing these cloths in hot weather.

IT'S A SMALL WORLD

In this same issue of "Textiles", we note a short, sharp and to-the-point article titled "Current Developments in the Application of Dyestuffs" by none other than our old friend Larry Thompson.

Another fact, probably not well known, that we gleaned from this paper was that South Africa still imports 300 million yards of cotton cloth and that local mills supply something less than 16% of the market requirements in this item.

CELEBRATION

When this appears in print, the glorious Fourth will have come and gone. The Declaration of Independence will have been redeclared from many a decorated platform on many a village green by many a decorated declaimer, fireworks will have been fired by local firemen of many a midget municipality.

The tumult and the shouting are over.

We have remembered that our forefathers fought for freedom. Let us not forget that freedom is not free. We still have to fight for it. Selah.—Q.E.F.

• PATENT DIGEST •

EMULSIONS FOR WATER-PROOFING———Also for moth-proofing treatments G,2,02

USPat 2,804,391 (Atlantic Refining Co —— Keenan, Gozlow, Doan —— Aug 27, 1957)

Some attempts have been made in the past to render fabrics water repellent and mothproof at the same time by first impregnating the goods with the waterproofing agents and then, in a second bath, with an insecticide solution, eg, DDT. This procedure did not prove to be satisfactory because the mothproofing agent, applied in the second step, was found to remove part of the water-repellent finish.

The object in applying waterproofing and mothproofing agents from emulsions either in one or two steps reportedly has been attained by emulsifying the mothproofing component with an *anion-active emulsifier*, particularly with an amine salt of an alkylarylsulfonic acid, in contrast to previously used nonionic emulsifiers such as Triton X-100 (polyethylene glycol alkyl aryl ether).

Example: Two batches of mothproofing compositions were prepared with 25% DDT powder, 70% xylene and five percent of an emulsifier. One batch was emulsified with an amine salt of the anionic surfactant as mentioned above, the other batch with Triton X-100. Each of these batches was mixed with equal amounts of water, agitated to form a creamy emulsion, then added to a waterproofing concentrate consisting of water, paraffin wax, Carnauba wax and aluminum salts. Wool-fabric test samples were impregnated with these batches, cured at about 300° F and subjected to the "immersion absorption test" described in Federal Spec CCC-T-191a. The results reported in two tables show that the rewetting percentage of the samples treated according to the patented method did not exceed 39.4% and was below the rewetting percentage of the non-treated samples.

Among the references cited by the Patent Office:

US Pat 2,369,992 (Merck & Co/1945) describes a wax emulsion containing methylcellulose and an insecticidal substance homogenized with an Al salt solution.

US Pat 2,556,300 (Standard Oil Development/1951): insecticidal compositions consisting of equal parts of white petroleum oil, a petroleum alkaline sulfonate, and DDT dissolved in a volatile aromatic solvent.

PAUL WENGRAF

RESIN-FINISHED CELLULOSIC FABRICS———Loss in tensile strength because of chlorine treatment avoided G,2,04

USPat 2,804,402 (Monsanto Chem Co —— Williams —— Aug 27, 1957)

Crush-resistant finishes based on dimethyl-imidazolone-2 (dimethylolethylene urea) are known to affect tear and tensile strength to a greater degree than do finishes obtained with the commercially available, water-soluble methylated methylol-formaldehyde condensates. On the other hand, the fabrics treated with dimethylolethylene urea suffer less loss in tensile strength upon chlorination than do those treated with methylated methylolmelamines.

The object of the current invention is to produce crush-resistant, dimensionally stable fabrics which do not exhibit excessive loss on tensile strength after the chlorinating, drying and heating operations. This problem reportedly has been solved by impregnating textiles with an aqueous solution containing: a) a water-soluble, fully methylolated heterocyclic compound, the ring consisting of carbon atoms and two nitrogen atoms only; b) a thermosetting, water-soluble, infinitely dilutable methylated methylolmelamine; and c) a curing catalyst.

The ratio of a:b is within the limits of 4:1 to 2:1.

The compound preferred in "a" is dimethylol ethylene urea. Other examples in this group are dimethylol ethylene thiourea, dimethylol 1-3 propylene urea, and many others (col 5, lines 35-62).

To meet the requirements of "b," any thermosetting methylether of methylolmelamine may be employed as far as it is infinitely water-dilutable, containing varying amounts of combined formaldehyde and methanol (see col 5, line 63; col 6, line 17).

Catalysts preferred for "c" are phosphoric acid or hydrochloric acid salts of amino alcohols, such as aminobutanol phosphate, aminomethylpropanol hydrochloride, and so on. They should be added to the resin solution just prior to the textile treatment (see col 7, lines 20-42).

Example: Eight parts of a 50% solution of type "a" and five parts of an 80% solution of type "b" were mixed and stirred until homogenous. A small amount of a polyvinylacetate dispersion, a mixed cationic-anionic softener, and an aqueous solution of 2 amino-2-methyl propanol hydrochloride, adjusted to pH 8 with aminomethylpropanol, were further added. A fabric was impregnated with this solution, dried at 150° F and cured for five minutes at 300° F, then tested for damage caused by retained chlorine according to the Tentative Test Method 69-52, described in the 1953 *AATCC Yearbook*. The percent loss in tensile strength due to chlorine retention was 6 in the warp direction. Fabrics treated with solutions of type "a" alone suffered a 16% loss, and those treated with type "b" solutions, as high as 67% loss under otherwise equal conditions.

Among the references cited by the Patent Office:

USPat 2,582,614 (Am Cyanamid Co/1952) describes a resin composition consisting of polyethylated melamines and (optionally substituted) ethylene ureas.

USPat 2,690,404 (Dan River Mills/1954): 2.5 mols dimethylol ethylene urea plus one mol polymethylolmelamine (including etherfied products like M-3) are claimed to impart wrinkle resistance without yellowing or loss on strength [cf *Am Dyestuff Reptr* 47, 118 (1956)].

ANTISTATIC AND REWETTING AGENTS ——— Combination of hydroxyamines and polyhydric alcohols G,1

USPat 2,809,159 (Dexter Chem Corp —— Welles, Edelstein —— Oct 8, 1957)

This patent refers to compositions containing a) hydroxygroup-substituted amines of long-chain hydrocarbons, and b) polyhydric alcohols, such as polyglycols, glycerine, etc, to be used on all kind of fibers which are generally known to accumulate static electricity, especially synthetic fibers and blends thereof with other fibers.

Compounds of group "a" do not impart antistatic effects in themselves but promote these effects obtained by groups of component "b". It can be assumed that the amine compounds "a" take the static from the textile material and discharge it to component "b," which promotes the complete discharge of electricity from the textile goods. It has been observed that compositions of this type are somewhat substantive to the textiles so treated, even making possible a rinsing operation without removing the agents from the fibers.

Tests carried out by rubbing, eg,

Dacron against nylon, proved that no substantial static retention of the treated material could be measured in contrast to nontreated control specimens; in addition, excellent rewetting properties reportedly are imparted by the finish. It has been observed further that the water-spreading properties of component "b" in themselves do not give satisfactory antistatic results; they have to be combined with component "a" to meet the antistatic requirements.

Typical compounds in group "a" are alkylolamines of the constitution

$R.N(C_2H_4OH).CH_2.CH_2.CH_2.N(C_2H_4OH)_2$

wherein "R" is an alkyl chain of eight to 24 C atoms; condensates of higher amines with ethylene oxide, such as the water-soluble or water-dispersible products known at Ethomeens; and polyethoxylated quaternary ammonium salts. Mixtures containing varying amounts of ethylene oxide are preferred.

For component "b," polyethylene glycols (eg, polyglycol 200), other polyglycols, glycerine, sorbitol, etc, may be used.

In addition to "a" and "b," surfactants of the anionic type (eg, keryl benzene sulfonate) and lower alcoholic solvents (methanol, ethanol, etc) are found to be beneficial in improving the function and clarifying the solution.

Example: A mixture of Ethomeen C/12 and T/25 (coconut oil amine and tallow amine respectively condensed with ethylene oxide), polyglycol 200, the sodium salt of a sulfonated petroleum oil hydrocarbon (Socony Sulfate 784) and methanol is applied by padding, spraying on, etc. By reason of the substantivity of the composition, relatively weak solutions may be employed.

References cited by the Patent Office:

USPat 2,067,202 (Celanese Corp of Am/1937): the use of hydroxyalkylamines, salts, or other derivatives thereof is advocated to deelectrify acetate yarns in weaving.

USPat 2,684,311 (Celanese Corp of Am/1954) describes the lubrication of high-tenacity (stretched and saponified) acetate yarns with compositions of alkanolamineamides of higher fatty acids, combined with arylsulfonates and a mixture of higher alcohols. No antistatic effects are claimed.

DYEING OF POLYACRYLIC FIBERS ——— Cupric salts and naphthols combined C,4,07

USPat 2,812,998 (Deering Milliken Res Corp —— Evans, Rainey Jr —— Nov 12, 1957)

Difficulties in the dyeing of acrylic polymers or copolymers have quite generally been overcome by applying the cuprous-ion method. A serious disadvantage of this method, however, positions of alkanolamineamides of the dyeing process, otherwise nonsatisfactory results have to be expected.

According to the current specification, this drawback is eliminated by immersing the fibers in a dyebath containing an aqueous mixture of an acid dyestuff, a naphthol compound and a water-soluble *cupric* salt (sulfate or chloride). Thus the present method avoids the use of a cuprous salt and the addition of any reducing agent. Although the mechanism of the reaction has not been determined, it is believed that the naphthol compound might cause the absorption of copper onto the acrylic fiber; it has been observed that the presence of naphthol or derivatives thereof is absolutely necessary for carrying out this method.

Any acid dyes can be employed, but the monosulfonated acid dyes, eg, Acid Blue 78 (*CI* 62105), Acid Orange 7 (*CI* 15510) and many others, give the best results. The dyebath concentration should be between one to 10% of the textiles' weight. The appropriate concentration of the cupric salt is reported as one-half to two times the dyestuff's weight.

Either α-naphthol or β-naphthol can be employed, β-naphthol being preferred. However, substituted naphthols of any kind may be used instead. Satisfactory results reportedly are obtained with amounts of two to 10 percent of the fabric's weight. Higher percentages cause staining, obviously because of the low solubility of naphthols in acid-reacting media. The dyebath has to be adjusted to a pH below 4, eg, 2 to 3.

Example: A dyebath for a three-gram sample of Orlon #81 acrylic filament consisted of 0.5 g Acid Orange 8 (*CI* 15575), 25 ml of a 12.0% copper sulfate solution, and 1.5 gm β-naphthol in 300 ml water. Dyeing at the boil gave a dark orange within 20 minutes.

Among the references cited by the Patent Office:

Am Dyestuff Reptr 40, 750 (1951) [abstracted from an article by Field and Fremon in *Textile Research J* 21, 531-39 (1951)]: copper was found to enhance the pick-up of a wide variety of dyes, whether present in the dyebath as dissolved cupric or as cuprous compounds. Copper is assumed to be a dye assistant in its own right, not merely a promoter for dye assistants.

Am Dyestuff Reptr 41, P510-16 (1952) (Szlosberg): the dyeing of acrylic fibers according to the cuprous-ion method is discussed. Special additive control of cuprous salts ("drip method") is improved by adding phenol or benzoic acid as swelling agents.

Abstract

Printing Triacetate with Indigosols

Diserens, P, *Dyer* 119, 77-1, May 23, 1958.

Because of its strongly hydrophobic character, triacetate has a dyeing behavior similar to that of synthetic fibers; its water imbibition is approximately the same as that of nylon and Orlon 42. It is therefore logical that the dyeing and printing methods suitable for 2½-acetate should not give satisfactory results on triacetate. It has been necessary to use nonionic dyes such as the disperse dyes, and for the production of full colors it is generally necessary to have recourse to high-temperature dyeing or to the use of carriers. Some full shades such as navy blues and blacks have been dyed with selected disperse dyes which are capable of being diazotized and developed, using the regular method of dyeing with the base, diazotizing and coupling, or the alternate method which consists in applying the base and coupling component, either concurrently or consecutively, before diazotization.

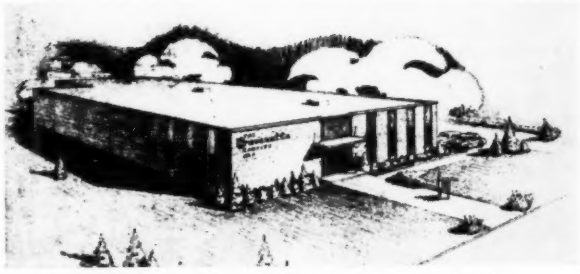
Certain azoic combinations of the naphthol series may also be used for producing dark shades on triacetate. The base and naphthol are applied concurrently, and color is developed *in situ* by diazotization.

The author refers to a process covered by German and French patents for dyeing triacetate with Indigosol dyes. The dye is first dissolved in presence of a reducing agent, and dyeing is carried out in an acidic medium. The dye is then oxidized by treating the goods in a sulfuric acid and sodium nitrite solution.

Printing of triacetate is much more difficult than dyeing. Pigment printing is unsatisfactory because of poor

(Concluded on page 536)

News of the Trade



Artist's conception of Cravenette's new plant

Cravenette Breaks Ground for New Plant

After approximately 70 years in Hoboken, NJ, The Cravenette Company, USA, has broken ground for a new plant at 60 Romanelli Ave, South Hackensack, NJ. It is expected that the new plant, larger and completely modern, will be ready for operation about October 1.

The move reportedly is compelled by the company's steady growth, and the addition in recent years of other products for diversified markets.

The new plant in South Hackensack will be all on one floor, air conditioned throughout with, for the most part, new equipment capable of handling a substantially increased volume of business. It is said the new location will provide easier accessibility and greatly improved shipping facilities.

More Cutters to Fabulize Lingerie

John L Fancourt, president of Fabulized, Inc, and Harry Eisenberg, president of Citation Fabrics Corp, have announced that five additional lingerie manufacturers have been licensed to use Fabulized nylon tricot in their garments.

These cutters are: Belinda Lingerie, Inc; Chelsea Lingerie, Inc, Sol Friedman and Sons (Formula slips); Sherman Underwear Mills; and Triangle Underwear Corp; all of New York.

RRL Acquires Additional Space

Robinette Research Laboratories, Inc has acquired additional office and laboratory space in the building located in Ardmore, Pa. Robinette Research Laboratories, Inc, offers consulting and laboratory services to the textile, paper, leather, metal processing and cosmetic industries.

Turbo to Manufacture Steverlynck Dyeing Machines

Turbo Machine Co, Lansdale, Pa, which last year purchased Smith-Drum & Co, former licensees in the U S for Steverlynck Static Process dyeing machines, has secured exclusive rights for manufacturing the machines in this country.

Turbo joins the following Steverlynck licensees throughout the world: Samuel Pegg of England, Krantz and Rudolf Then of Germany, Mezzara of Italy, Frauchiger of Switzerland, Serracant of Spain, Callebaut de Blicquy and Toleries Gantoises of Belgium, Boehler of Austria, and Static Argentina of Argentina.

RCI Forms South Florida Sales Territory

A new South Florida sales territory has been formed by Reichhold Chemicals, Inc, to provide increased service to manufacturers in the area using inorganic chemical colors and synthetic resins.

Ralph L Johnson, formerly with RCI's Jacksonville, Fla, office, will manage the new territory from offices in Miami Springs. He joined the firm in 1931, and has worked from the Jacksonville office since 1952.

Reichhold's new office is located at 4471 NW 36th Street, Miami Springs. The firm now has 34 sales offices and plants in the United States, and 72 others in Canada, Latin America, Europe, South Africa and Asia.

Acetonyl Acetone Available Commercially

Aceto Chemical Co, Inc, 40-40 Lawrence St, Flushing 54, NY, has announced the commercial availability of acetonyl acetone in drum lots. The supply of this material has hitherto been irregular and it is expected that its continuous availability will promote its uses in dyes, pharmaceuticals and metallic chelates.

New Armour Ethoxylation Unit

A new ethoxylation unit is being put on stream this month by the Chemical Division of Armour and Company. According to M E Lewis, division general manager, the new unit will assure increased product availability, better service, a more complete product line, as well as price reduction. This unit is located in the chemical plant at McCook, Ill.

The etho-chemicals, the term used by Armour for its ethoxylated aliphatic organics, include these trademarked products: Ethofats, Ethoduomeens, Ethomids, Ethomeens and the newest addition to the line, Ethoquads.

These chemicals are made by ethoxylating respectively, fatty acids, diamines, amides, amines, and quaternary ammonium salts. They have applications as emulsifiers, detergents, wetting agents, dispersants and suspending agents.

Shell to Add Acrolein Unit at Norco

The Lummus Company of 385 Madison Avenue, New York 17, NY, has been awarded a contract by the Shell Chemical Corp to engineer and construct an acrolein unit at its Norco, La, plant.

This unit is part of a program costing more than $10,000,000 that is being undertaken by Shell to construct the remaining facilities in their glycerine production program at Norco.

The acrolein unit is scheduled for completion late in 1959 and reportedly will help the Norco plant produce about 35 million pounds of glycerine a year plus substantial quantities of acrolein, a chemical not made in large volume until the development of the present process.

Shell believes that a wider availability of acrolein will lead to a greater variety of end uses for the product.

A second unit in the expansion program will make glycerine, using acrolein and hydrogen peroxide from a unit that the company completed earlier this year.

In addition to the new acrolein unit, other work done by Lummus for the Shell Chemical Corporation includes Epon Resins units at Houston, Texas and a bisphenol unit at Houston.

VDI Launches "Back-to-School" Promotion

The importance of colorfastness in "back-to-school" apparel fashions is spotlighted in a nationwide promotion program now being launched for fall by The Vat Dye Institute.

Geared to the theme "Happy Schooldays—Happy Washdays," the drive stresses the message that vat colors are the fastest colors money can buy, providing maximum fastness to washing, drycleaning, sunlight, household bleach, perspiration and rubbing off. The Institute adds the note of "happy selling days" for stores featuring garments of vat-colored fabrics.

To help stores plan and execute their own back-to-school-promotions the Institute has prepared a new merchandising kit, currently being presented to leading stores in 20 key market areas and distributed to another 400 throughout the United States.

Included in the kit is a series of effective window display suggestions and newspaper ad layout and copy ideas for utilizing the "built-in" sales appeal of the vat color story; blow-up of the "Vat Colored" identification tag; Vat Dye garment hangtags; booklets for sales personnel, publicity releases for local store use, and an idea bulletin on ways to give added force to 'back-to-school' fashion promotions. In the kit is a new sales memo, made to fit in a sales clerk's order book, for answering typical consumer questions about vat colors, and a wallet-size "family shopper's memo" as a giveaway item for customers to keep permanent records of birthdays and clothing sizes.

Nopco Moves to Newark

Nopco Chemical Company and its subsidiary, Metasap Chemical Company, has moved its general offices to 60 Park Place, Newark, NJ. The new headquarters will accommodate the firm's executive, accounting, advertising, and sales departments.

The transfer to Newark reportedly will provide more facilities in Harrison, NJ, for Nopco's expanded laboratory activities, an essential factor in the expansion program of the company. The firm's engineering, legal, production, purchasing, receiving, and shipping departments will also continue to operate at the Harrison plant.

Sun Chemical Acquires CML

Sun Chemical Corporation has purchased Coating Materials Laboratories, Nutley, NJ, manufacturers of a diversified line of industrial coatings and finishes.

Julius E Spector, vice president of Sun Chemical and general manager of its Paints and Finishes Group, said that the acquisition of Coating Materials Laboratories, a cash purchase, is a part of Sun's long-range expansion and modernization program. The new company, which reportedly grossed more than $1,000,000 in sales last year, will be operated as an autonomous division in Sun's Paints and Finishes Group.

H A De Phillips, president and general manager of CML, and his entire staff will continue in the same capacity under the new management.

"In Coating Materials Laboratories, Sun Chemical Corporation has acquired an outstanding finishes company with national distribution and top quality equipment," Mr Spector said.

Sun also acquired many important patents developed by Dr De Phillips and his staff.

Thornley to Represent Sole Chemical

Sole Chemical Corp, Chicago, Ill, producers of surfactant specialties, has appointed The H D Thornley Co as its technical sales representative for the eastern half of Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, West Virginia, and the southern and western portions of New Jersey.

The Thornley organization, with headquarters at 901 Liftwood Rd, Wilmington, Del, also has an office in Philadelphia, Pa.

HRL Continues Cooperation with Teachers Institute

Harris Research Laboratories, Inc, Washington, DC, is again this year cooperating with the "Chemistry-Physics Teachers Institute" under the sponsorship of the National Science Foundation by accepting five high school science teachers as guest workers.

The teachers divide their time between attending lectures on new developments in physics and chemistry at American University and actively participating in the various textile chemical research and development activities carried on at the Harris Laboratories.

• NEW PRODUCTS AND DEVELOPMENTS •

Monastral Red Pigments

Development of a new family of red pigments, with lightfastness and other properties which make possible durable red shades for fabrics and other products, was announced by the Du Pont Company in connection with the opening of a new customer service laboratory by the Company's Pigments Department on May 21st.

A new unit has been constructed at the Newport, Del, plant for the manufacture of the new Monastral red pigments, preliminary production of which is now under way. Commercial quantities will be available this fall, according to M J McLain, colors sales manager for the Department.

"Pigments in the red portion of the spectrum have been extremely weak in outdoor exposure durability, particularly in the pastel shades", Mr McLain said. "The Monastral reds offer a combination of properties not found in any commercial red pigment today."

The result of 13 years of research and development, the Monastral reds and violets have properties similar to Monastral blues and greens developed by Du Pont. They reportedly combine excellent lightfastness, brilliance, bleed resistance, chemical inertness, heat stability, working properties, and a desirable shade range. Because of the intensity of Monastral reds, it is claimed that strong colors can be produced even when let down with white or used in metallic or polychromatic finishes.

Mr McLain said one of the first major uses of the pigment is expected to be in the automobile finishes field, in metallized finishes, tints and as toning colors. Other major uses include color tints in plastic products and mass pigmentation of synthetic textile fibers.

In fabrics, Monastral reds are expected to solve many fading problems. Because of the lightfastness of the pigment, it is claimed that the housewife need not worry about the fading of draperies, carpets, and upholstery fabrics. Pigmented acetate or viscose rayon reportedly provide excellent performance in light shades or blends. No other red pigments with similar color properties have the required lightfastness when used in low concentrations, it is claimed.

ROLLS COVERED WITH UNION CARBIDE SILICONE RUBBER COMPOUNDS OF THE NEWEST TYPES——Picture shows one of the early steps in the fabrication of a roll at the rubber factory. The various layers of silicone rubber which are added to build up the roll are cured into one solid mass when a compound, such as Union Carbide XK-1039 is used with the catalyst, Union Carbide X-1960 Curing Compound.

Union Carbide XK-1039 Silicone Rubber Compound

A new, extremely hard, general-purpose compound is now available from Silicones Division, Union Carbide Corporation. Designated Union Carbide XK-1039 Silicone Rubber Compound, this 85 ±5 Durometer hardness material reportedly has low compression set, low moisture absorption, high temperature stability, good release properties, and does not require the use of toxic additives. It is further claimed that it can be easily molded, calendered, or extruded, making it particularly suitable for fabrication of rubber rolls which are to be used in the textile, plastics, paper, and printing industries.

A four-page data sheet (SF-1124) describing the properties of the compound, the catalysts that may be used, and the catalyst concentrations is available from Silicones Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, NY.

Cibanone Green 6G Paste

Ciba Co, Inc has introduced a full yellowish green shade in its Cibanone Green 6G Paste, which it recommends for shirtings, raincoat material and colored woven goods.

The new Ciba specialty is said to offer excellent light- and all-around fastness properties, to be stable to chlorine and suitable for vulcanization.

It can be applied as a pigment and in continous operations.

Proctor-Hart Pile-Fabric Finisher

Adolph Hart, designer and manufacturer of the Hartex finishing machinery for pile fabrics, both in the fur and synthetic fiber fields, recently announced his association with Proctor & Schwartz, Inc, Philadelphia, Pa, to produce his latest finishing machine, to be known as the Proctor-Hart pile-fabric finishing machine.

It is reported that important new features are to be contained in the new Proctor-Hart machine including gas heating of advanced design, improved fabric handling, and two or more main cylinders in series contributing to reduced first costs, operating costs and maintenance.

It is stated that, because of the tremendous upswing in production in the synthetic fabrics field in the past few years, leading manufacturers have expressed the desire for a finishing machine that could give them more production with less handling. The new Proctor-Hart Finisher reportedly will attempt to meet this challenge.

Hummel Offering Lead Nitrate

Hummel Chemical Company, Inc, 90 West Street, New York, NY, is offering lead nitrate 99.2% purity.

This chemical is used, among other applications, in dyes and pigments, process material in the manufacture of lead salts and organic compounds, analytical reagent, etching agent, and textile dyeing.

The lead nitrate is a strong oxidant.

A technical data sheet and further information are available on request.

Larvatex

The Hart Products Corp, 1440 Broadway, New York, NY, has announced the commercial availability of Larvatex, an emulsifiable concentrate of Dieldrin, for permanent mothproofing of wool, when applied in the dyebath to wools, worsteds, and hair fibers. It is said to give permanent mothproofing protection durable to repeated laundering and drycleaning which meets the requirements of the ASTM Permanent Mothproofing standards and the standards of the U S Department of Agriculture.

Larvatex is claimed to offer permanent mothproofing protection at very low cost and to feature ease of application. Full technical assistance on the application of Larvatex and the testing of treated goods for mothproofing efficiency are offered by the company.

Process Heating Radiant Burners

According to Process Heating Co, economies in drying and processing are being achieved throughout industry by the use of radiant, or infra-red, gas burners developed by the Paramus, NJ, firm.

Stating that drying and heat processing can be efficiently accomplished only after the material has been heated to a suitable temperature, the Company points out that heat-up time can be costly in equipment and space. It is suggested that the ability of Process Heating radiant burners to transfer a vast amount of heat to the material or parts being processed, in a short time and space, makes it possible to obtain increased production with less costly equipment.

Process Heating burners reportedly can be installed ahead of ovens and cylinder-type dryers to set coatings, printing and various finishes before surface of the material makes contact with dryers or carrying rolls. The burners, it is claimed, can be operated in any position, making it possible to install them above and below material handled in continuous form or conveyors carrying pieces being processed.

Applications in textile mills include tenter frames, drying cans, slashers, singeing machines and ovens.

Further information may be obtained by writing to Process Heating Co, PO Box 171, Paramus, NJ.

Safe-T-Set Resin

Proctor Chemical Company, Salisbury, NC, has announced the release of Safe-T-Set Resin, which it describes as producing excellent wrinkle recovery and fabric stabilization without contributing to the loss in tensile strength of fabrics subjected to standard chlorine damage tests. It is said to be specifically designed for use on fabrics that are normally exposed to chlorine bleaching by the consumer and where chlorine degradation is a problem.

Molded Polyester Filter Plates

Molded polyester is being offered as the answer to the long-standing need for a low-cost filter plate with good all-around chemical resistance and good physical properties by T Shriver & Co, Harrison, NJ. Molded polyester plates are claimed to offer a combination of advantages not attainable heretofore with a single plate material. The advantages are said to fall into four areas: versatile chemical resistance, reduced weight, reduced cost, and performance.

One of the major virtues of the molded polyester plates, according to R K Jessen, sales manager at Shriver, is their wide range of corrosion resistance. These plates, molded from Thermaflow #100, a reinforced polyester molding compound manufactured by Atlas Powder Co, Wilmington, Del, reportedly have good-to-excellent resistance to a variety of chemicals, including hot mineral acids and alkalis, hypochlorites, peroxides and chlorides, and such organic solvents as carbon tetrachloride and alcohols. The molded plates, therefore, are said to offer better all-around chemical resistance than most materials currently used in filter plates. For example, stainless steel is not used with HCl or other chlorides; aluminum is useful only with neutral solutions; cast iron requires a protective coating to prevent corrosion and oxidation. These plates, it is claimed, fill the need for a long-lived economical material for handling corrosive slurries containing dyes and intermediates. Wooden plates, which have been commonly used for dyestuff applications, have an excessively short service life owing to warpage of the wood from repeated wetting and drying and require frequent replacement.

The polyester plates reportedly weigh only about one-third as much as the same size units made from the standard corrosion-service materials, ie, coated cast iron, nickel-iron, bronze, stainless steel, etc. Thus, a 36-inch polyester plate weighs about 80 lb, whereas the same plate in cast iron or bronze weighs 265 lb, and in stainless steel, 200 lb. (The cured plastic has a specific gravity of 1.8, about ⅔ that of aluminum.) Translated into shipping and handling considerations, this weight reduction means an aggregate saving of two to three tons in an average 30-plate, 36-inch press. Furthermore, it is suggested that the lower weight of the individual plates makes them much easier to handle and separate when the press is opened several times a day to remove the filter cake.

In addition to these advantages, the polyester plates are said to offer substantial economy over other chemically resistant materials. For example, a 36-inch plate reportedly costs 10% less than a good quality, rubber-coated cast iron plate, and only about ⅓ as much as an 18-8 stainless steel plate. Although currently available only in a 36-inch size or smaller, larger plates are entirely practical.

Broad chemical resistance, lower weight, lower cost and improved surface finish are claimed for these filter plates molded from Atlac Thermaflow polyester premix molding compound. This 36-inch corrugated plate is the largest piece (in weight and area) molded from this material to date. Side flanges are attached by bolting directly into the polyester.

Being compression molded, the surface of the polyester plates is smooth and free of pores and pits that might trap sediment. It is stated that the smooth surface can be cleaned thoroughly and reduces the possibility of product contamination between batches or when the press is used for filtering several types of materials. Furthermore, being a homogeneous material throughout, the plates reportedly are not subject to the corrosion or deterioration problems common with coated plates when the protective coating is chipped or abraded in service. The polyester is said to be easy to machine, so that the joint surfaces can be ground to high smoothness and parallelism to provide a leak-tight seal between the plate and frame.

Light weight of the polyester plate is illustrated by the relative ease with which this 36-inch plate can be handled and lifted. This plate weighs about 80 lbs.

Atlac Thermaflow #100 is one of a series of polyester premix molding compounds containing glass fiber or nylon rag reinforcement, which are formulated to provide the desired balance between chemical, electrical, mechanical and molding properties. The superior chemical resistance of this series is attributed largely to the use of Atlac 382 resin, a specialty polyester resin. It is claimed that the flexural strength (15,000-20,000 psi) and impact strength (10-15 ft lb/in notch) are somewhat lower than those obtainable with preform moldings, but are nonetheless superior to the values for conventional polyester premixes.

Shriver's polyester filter plates are reportedly interchangeable with other plates used in presses of the same type. Introduced about six months ago, several hundred 36-inch plates are already in use for production operations at several major chemical producers. The plates are molded for Shriver by the Molded Products Division of the Admiral Corporation in Chicago, and the U S Rubber Co, of Passaic, NJ. The compound is molded at 275° F at approximately 1500 psi. Smaller parts often can be molded at 400 psi. Because the charge is unusually large, the mold is closed quite slowly, and the curing cycle is approximately 15 min. The complete cycle requires about 20-25 min. For thinner sections (ie, ⅛" thick) molded from Thermaflow, a rapid closing speed and a 1¼-minute cure are more typical, with molding temperatures in the range of 300-320° F.

Naphthol Blue Black B Conc Purified

Release of Naphthol Blue Black B Conc Purified has been announced by Sandoz, Inc. The new dye is said to provide an acetate reserve equal to that of premium-priced blacks for wool, and to be equal, in all other properties, to Naphthol Blue Black B Conc (Acid Black 1, *CI* 20470). Customer leaflets on this dye are available from the Sandoz district sales offices.

• NAMES IN THE NEWS •

Hanlon

John J Hanlon, technical director, Mohasco Industries, Inc, Amsterdam, NY, will serve as judge in new contest for industrial scientists. The contest, called "Jobs for Tomorrow," is the first competition ever held solely for laboratory experts. Sponsor is Microbeads, Inc, of Toledo, Ohio.

Robert J Kingsley has been named, as of July 1st, to the newly created position of general sales manager for the Pacific Division of the Nopco Chemical Company.

In addition to his new duties, Mr Kingsley will continue in the capacity of sales manager for the Fine Chemicals Division. As general sales manager, he will be in charge of the new expanded sales program and the administration and direction of sales efforts for all of the company's sales divisions in the eleven Western states.

The Pacific Division maintains sales and production headquarters at Richmond, Calif.

Clemson College has announced the following scholarship winners in its textile school:

Mack E Atkinson, a junior, is the new recipient of a $500 Ciba Co Scholarship in textile chemistry. The 1957-8 scholarship, also for $500, awarded to **Robert H Barker,** a senior, has been renewed.

James Nolan Etters, a junior who is attending Clemson on a Spring Mills Loan Scholarship, has been awarded a $500 Blackman-Uhler Scholarship. Last year's B-U scholarship, held by **Henry H Perkins Jr,** a senior, has been renewed.

Walter Wayne Freed, a textile engineering senior, has been awarded the $500 American Viscose Scholarship in textiles.

Eugene J Wollschlager, recently returned from a tour of duty with the United States Army in Western Germany, has assumed the position of administrative assistant to **Hillary Robinette Jr,** president of Robinette Research Laboratories, Inc, Ardmore, Pa.

To coordinate more effectively direct field activities, the Chemical Division of The Goodyear Tire & Rubber Company has created three new district manager positions.

Appointed to fill the posts are **A R Merritt,** Hartford, Conn, **L P Thies,** Detroit, Mich, and **L E Stanton,** Houston, Tex.

Merritt

Thies

Stanton

The Goodyear Chemical Division, with 15 field offices throughout the country, markets high polymer resins, rubbers and latices. Complete sales and technical service for all products will be available from the new district offices.

Mr Merritt joined Goodyear in 1948. He transferred to the Chemical Division in 1954 and was special representative in Hartford until his latest appointment.

Thies, with previous experience in sales development of synthetic fibers and sales of industrial coatings and vinyl dispersions, joined the Goodyear Chemical Division in 1956. He was assigned to the division's Cleveland, Ohio office in 1957 and later transferred to Detroit as special field representative.

Stanton joined Goodyear in 1954 and had previous experience in the chemical industry as a chemist and technical representative. Prior to his latest assignment, he had served as special representative for the Chemical Division in Houston.

Mercer

Robert Mercer has been named to fill the newly created position of technical service representative for the Adell Chemical Co, makers of Lestoil liquid detergent.

Mercer's services will be available to textile mills and laundries who wish to obtain information on how to use Lestoil products to best advantage in their operation and to assist in solving specific soil-removal problems.

Mr Mercer was formerly employed by the General Aniline and Film Corporation as a product engineer.

An expansion of the chemical products marketing group of National Carbon Company, Division of Union Carbide Corporation, has been announced. To extend customer service and improve the efficiency of the national sales organization, two field sales divisions have been established with headquarters in New York and Chicago.

E S Malkin, formerly chemical products field salesman in New York, has been named eastern division manager. Mr Malkin will report to **W W Palmquist,** manager, and will direct the field activities in sales territories in the eastern half of the United States.

J F Brauning, formerly chemical products field salesman in Chicago, has been appointed western division manager. Reporting to Mr Palmquist, Mr Brauning will be responsible for sales operations in the western half of the country.

J M Brown, former chemical products salesman in Birmingham, assumes Mr Brauning's responsibilities in the Chicago area. **T W Manchester** becomes chemical products salesman in Birmingham.

D S Glass, previously a member of the chemical products headquarters marketing staff in Cleveland, has been named to the field sales position in New York formerly held by Mr Malkin.

TECHNICAL LITERATURE

(Literature is available from sources shown in italics)

ACCESSORIES FOR THE MICROSCOPE—*Ernest F Fullam, Inc, PO Box 444, Schenectady 1, NY*———Ernest F Fullam, Inc, consultants in industrial development, control, research (electron & light microscopy) has prepared a brochure and catalogue of accessories for the entire microscope field.

ADIPIC ACID—*National Aniline Div, Allied Chemical Corp, 40 Rector St, New York 6, NY*———Technical Bulletin I-12R has been completely revised to include current information on this widely useful reactive dicarboxylic acid. The revised edition comprises 36 pages of basic data for the researcher—including physical properties, six pages of chemical properties and reactions, 19 pages of suggested use and a list of 271 literature references. Included also is a "family tree" diagramming the basic reactions of adipic acid.

APPLICATIONS OF HIGH-PRESSURE ACETYLENE DERIVATIVES—*Antara Chemicals 435 Hudson St, New York 14, NY*———This technical brochure outlines the properties and uses of high-pressure acetylene derivatives, featuring their applications to textiles, resins, detergents, corrosion inhibitors, etc.

The structures and physical forms of eleven high-pressure acetylene derivatives, which are offered in commercial quantities, are included. These represent water-soluble polymers, copolymers, monomers, specialty chemicals, solvents and intermediates. Antara Chemicals also reports that other selected derivatives of chemicals outlined in the brochure are available in pilot-plant or laboratory quantities from GAF's continuing research in the field.

ASTM STANDARDS COVERING COTTON FIBERS—*30c each; American Standards Assoc, 70 East 45th St, New York 17, NY*———Eight standards of the American Society for Testing Materials covering cotton fibers, which have been approved as American Standards, are available from ASA as follows:

American Standard L14.92-1957, ASTM Designation D 1441-54, Standard Methods of Sampling Cotton Fibers for Testing;

American Standard L14.95-1957, ASTM Designation D 1444-56, Standard Method of Test for Cross-Sectional Characteristics of Cotton Fibers;

American Standard L14.96-1957, ASTM Designation D 1445-57, Standard Method of Test for Strength of Cotton Fibers (Flat Bundle Method);

American Standard L14.97-1957, ASTM Designation D 1446-53T, Tentative Method of Test for Number of Neps in Cotton Fibers;

American Standard L14.98-1957, ASTM Designation D 1447-54T, Tentative Method of Test for Length of Cotton Fibers by Fibrograph;

American Standard L14.99-1957, ASTM Designation D 1448-56, Standard Method of Test for Fineness of Cotton Fibers by Micronaire;

American Standard L14.100-1957, ASTM Designation D 1449-55T, Tentative Method for Determining the Specific Area and Immaturity Ratio of Cotton Fibers (Arealometer Method);

American Standard L14.101-1957, ASTM Designation D 1450-57, Standard Method of Test for Maturity of Cotton Fibers (Polarized-Light Method).

DIRECT DYE GUIDE — *American Cyanamid Co, 30 Rockefeller Plaza, New York 20, NY*———Developed to assist dyers in the successful use of direct dyes, this unique chart categorizes 93 direct dyes that build up, decompose or remain stable under certain dyeing conditions. It tells the dyer what additives to use, what temperatures to select, and how to keep "spoils" and "seconds" down.

Direct dyes are widely used because of their relatively low cost and good fastness properties. One disadvantage, their irregular behavior, may now be overcome more easily with the aid of this Dye Guide, according to Cyanamid representatives.

The chart is available through the company's dyes department salesmen.

FALL FASHION BULLETIN 1958—*The Jersey Institute, 1270 Sixth Ave, New York, NY*———This issue of "The Jersey News" offers a summary of fashion news of interest to manufacturers of wool jersey.

PROCEEDINGS OF THE SIXTH ANNUAL CHEMICAL FINISHING CONFERENCE — *National Cotton Council, 1200 18th St, NW, Washington 6, DC*———This 82-page booklet, as reprinted from *Textile Research Journal*, contains full texts of all papers delivered at the Conference held in October, 1957.

REPORT ON TRENDS IN TEXTILES—*Cold Spring Bleachery, Yardley, Pa; Cold Spring Industries, 350 Fifth Ave, New York, NY*———Hints to converter, cutter and retailer on how to avoid hazards implicit in "wash & wear" promotion are supplied in the 1958 annual "Report on Trends in Textiles" released by Cold Spring Bleachery under a June dateline.

Reviewing wash & wear developments at length, Cold Spring speculates that finishers will soon have a set of standards "you can lay a yardstick on." The prediction is made that the most successful converters will be those who consult with the finishers as to what they desire in finish performance and then engineer their lines "to give us a fabric with which we can achieve the results."

In a signed column, Cold Spring's President John F McCarty cites current activity in the continuous improvement program at the Yardley, Pa, finishing plant. Included are references to the new system for handling resins in the makeup room, a new storehouse for chemicals in close proximity to the mixing tanks, and the new water purification system. Mr McCarty also reviews the tests of work in progress which cross his desk.

In his signed column "From The Empire State," James Tutton, president of Cold Spring Industries, New York, NY, states the views on wash and wear of the bleachery's distribution organization. Styles cut from fabrics finished by Cold Spring are modeled in a page of fashion photos.

THE STORY OF VAT DYES—*Vat Dye Institute, Inc, 350 Fifth Ave, New York 1, NY*———This new 16-page educational booklet about vat dyes, their development, use in the textile industry today and significance to the consumer, is prepared in easy-to-understand, non-technical language for students, teachers, home economists, retail store personnel and other interested trade and consumer groups. It explains what vat dyes are, why they are the fastest and highest quality colors known, how and where they are applied, and the chief benefits of vat colors to the consumer, manufacturer and retailer of apparel and decorative home furnishings fabrics.

Abstract———

(Concluded from page 530)

crockfastness. Vat dyes can be printed by the Manofast process, but the range is limited and a long aging is necessary. Disperse dyes lack fastness and require a long pressure aging.

The author undertook an investigation in the field of carriers, to find a suitable one for printing Indigosols on triacetate. Among the numerous compounds investigated, the halogenated alkylphenols were found to give the best results. Fixer TRA, marketed by Durand and Huguenin, belongs in this category.

A formula is given for printing Indigosols with the addition of Fixer TRA, sodium nitrite, and starch-trag or similar thickener. The prints are aged for 4 minutes, and are developed in a sulfuric acid solution at 158°F. Most of the Indigosols can be printed by this method. The fastness is said to be at least equal to that on cotton.

Bright, deep shades are obtainable on the triacetate, as well as on certain blends with other fibers.